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OF

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ERRATA.

Page 6. Footnote, line 3. After the words "in any way" add "except by the making the sine value for January + 20 instead of — 52."

Page 6. Footnote, line 6. Instead of the equation forming this line, insert

$$S_0 = 32 - 23 \cos \Theta + 20 \sin \Theta + 6 \cos \Theta - 10 \sin 2 \Theta - 3 \cos 3\Theta - 9 \sin 3\Theta.$$

Page 40. Line 1. For θ read 2θ.

Page 60. Line 6 from bottom. For "warmest" read "narrowest."

Page 74. Table III. For 3, 4 or 5 p.m., read 3, 4 or 5 a.m.

Page 88. Rainfall for Year. For 67·04 ins. read 57·04 ins.

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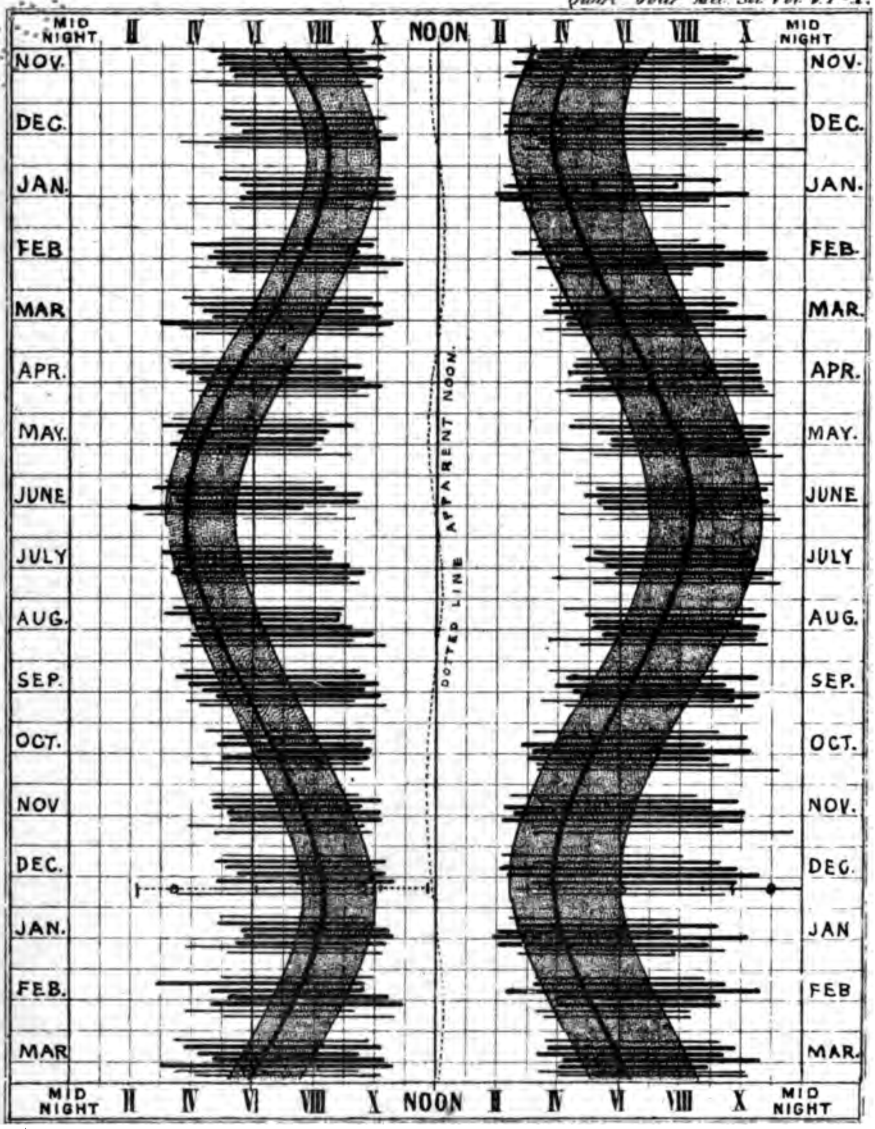
MBL WHOI

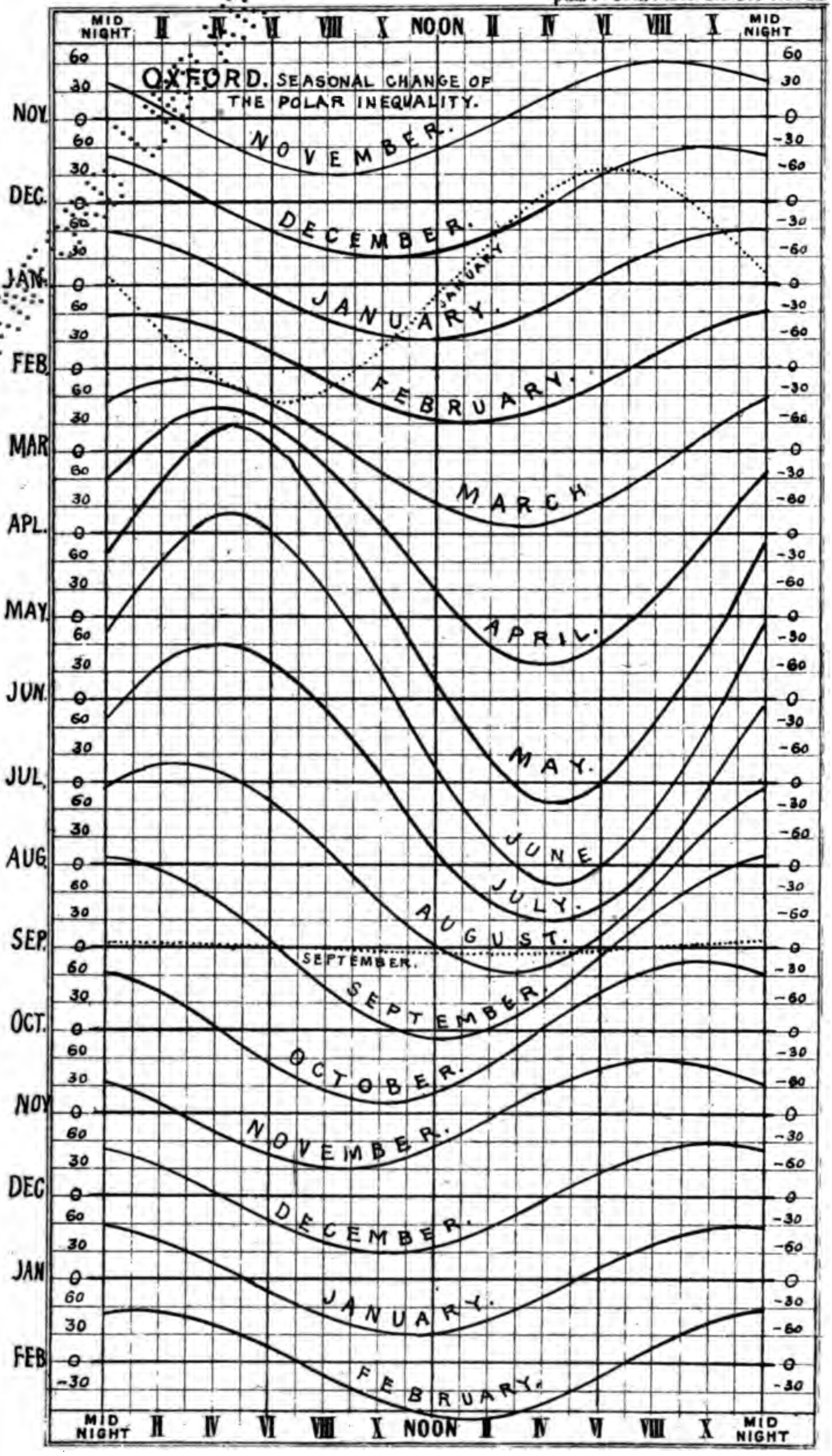
BAROMETER. DAILY INEQUALITY.

Quart Jour Met Soc Vol V P^t. I.



TROPICAL HOURS, LAT. 51·30, NORTH.

BAROMETER. DAILY INEQUALITY. *Quart Jour. Met. Soc. Vol. V. Pt. II*



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BAROMETER. DAILY INEQUALITY.

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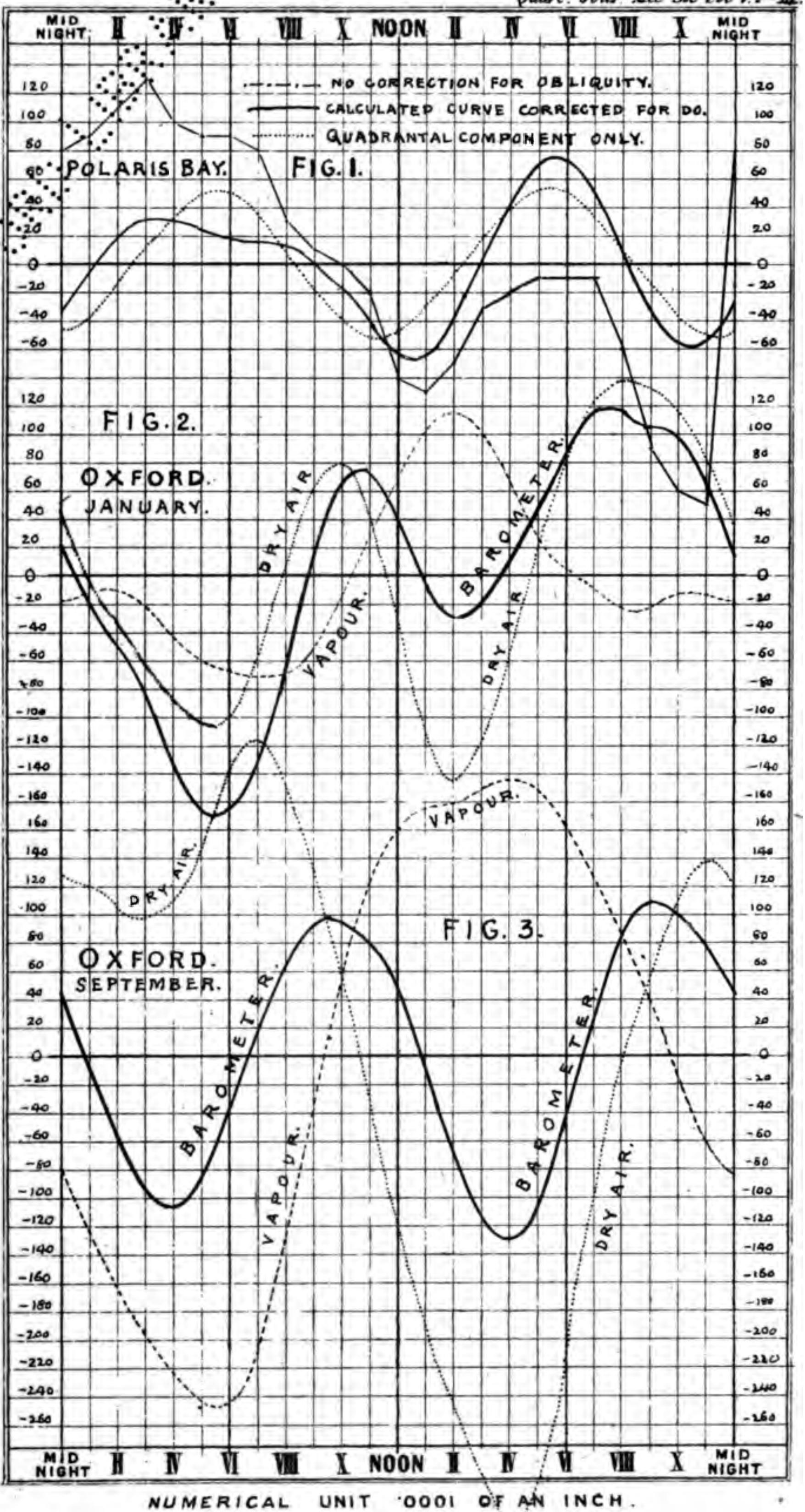

FIG. 1.

FIG. 2.

FIG. 3.

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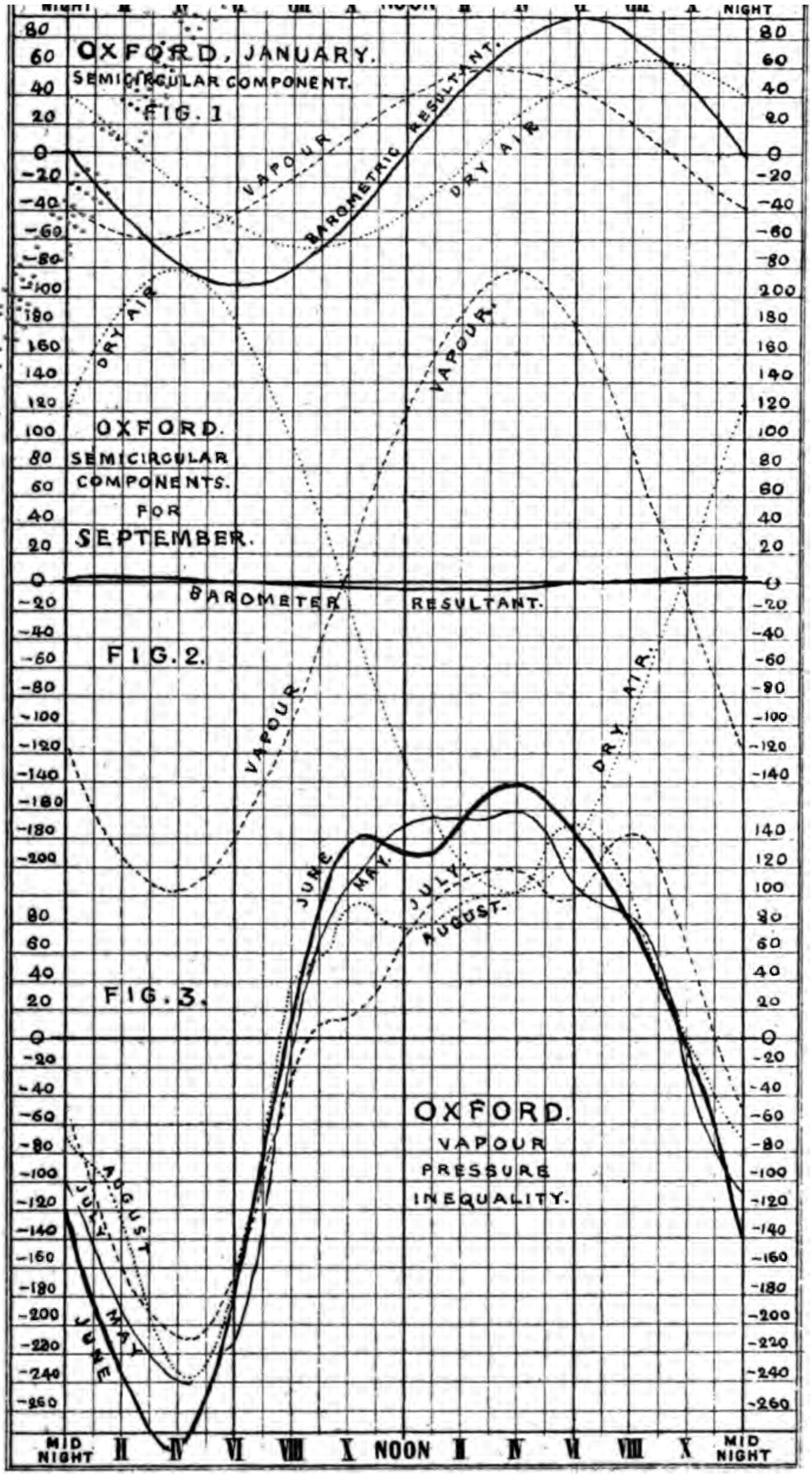

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BAROMETER. DAILY INEQUALITY.

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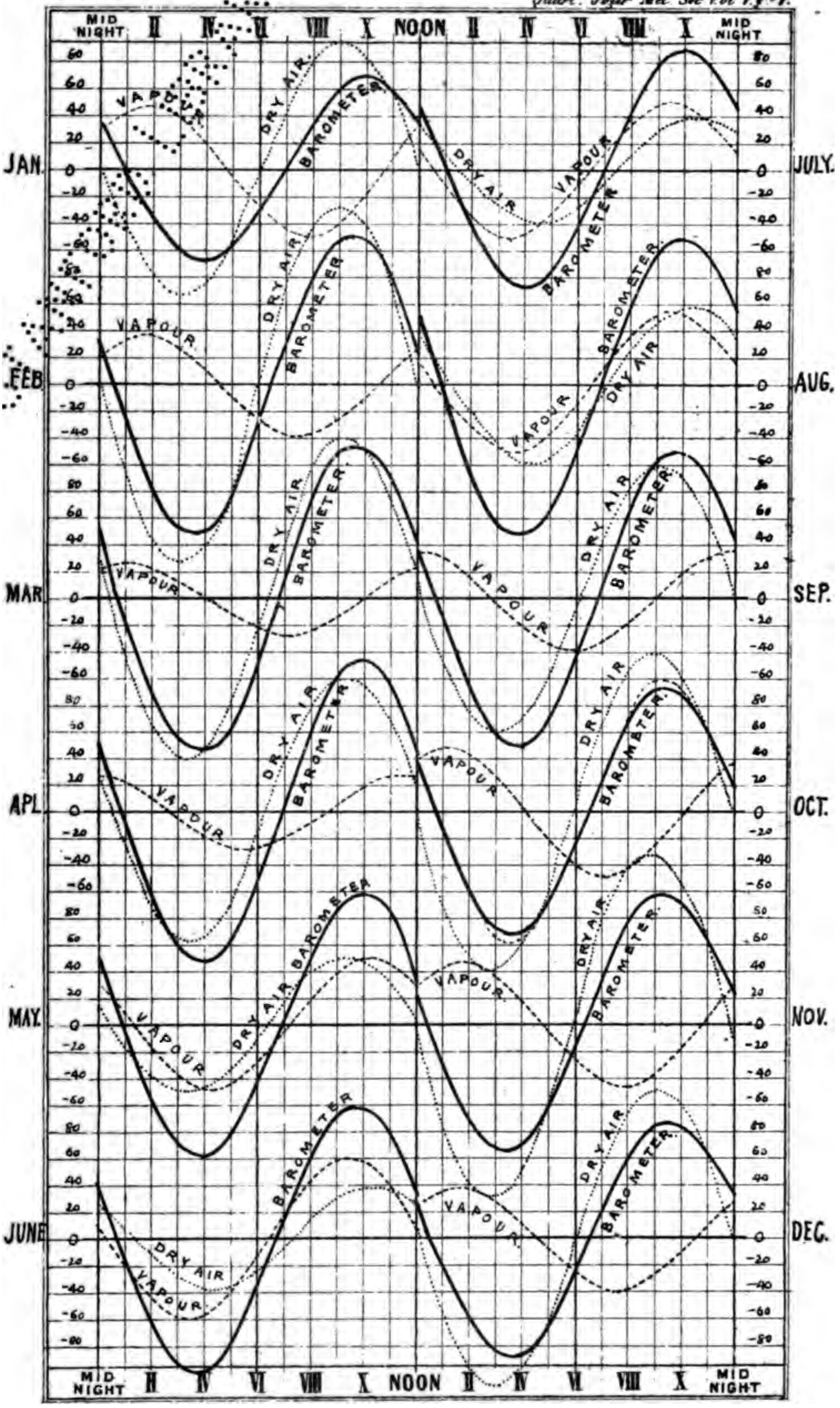

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OXFORD. QUADRANTAL COMPONENTS.

BAROMETER DAILY INEQUALITY.

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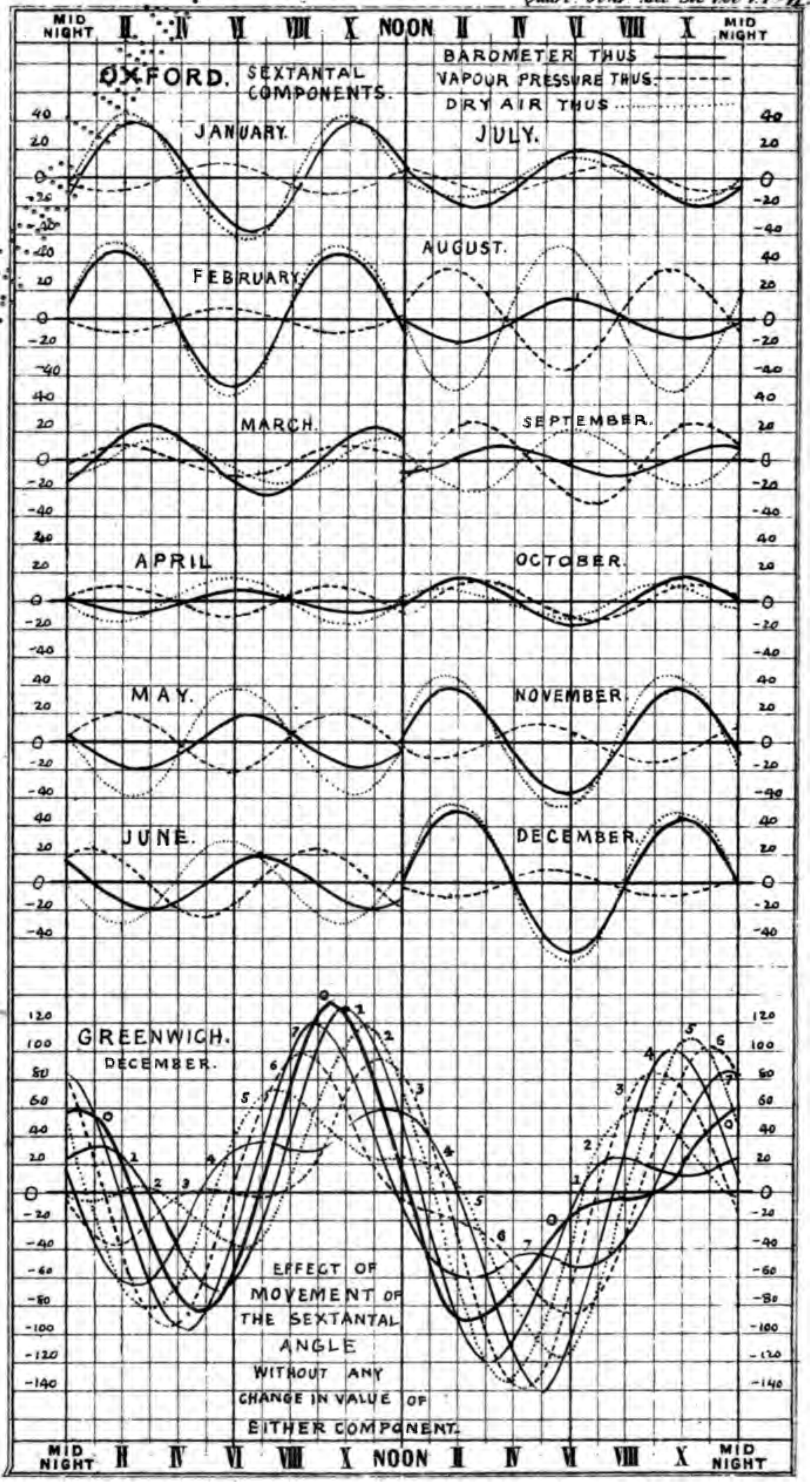

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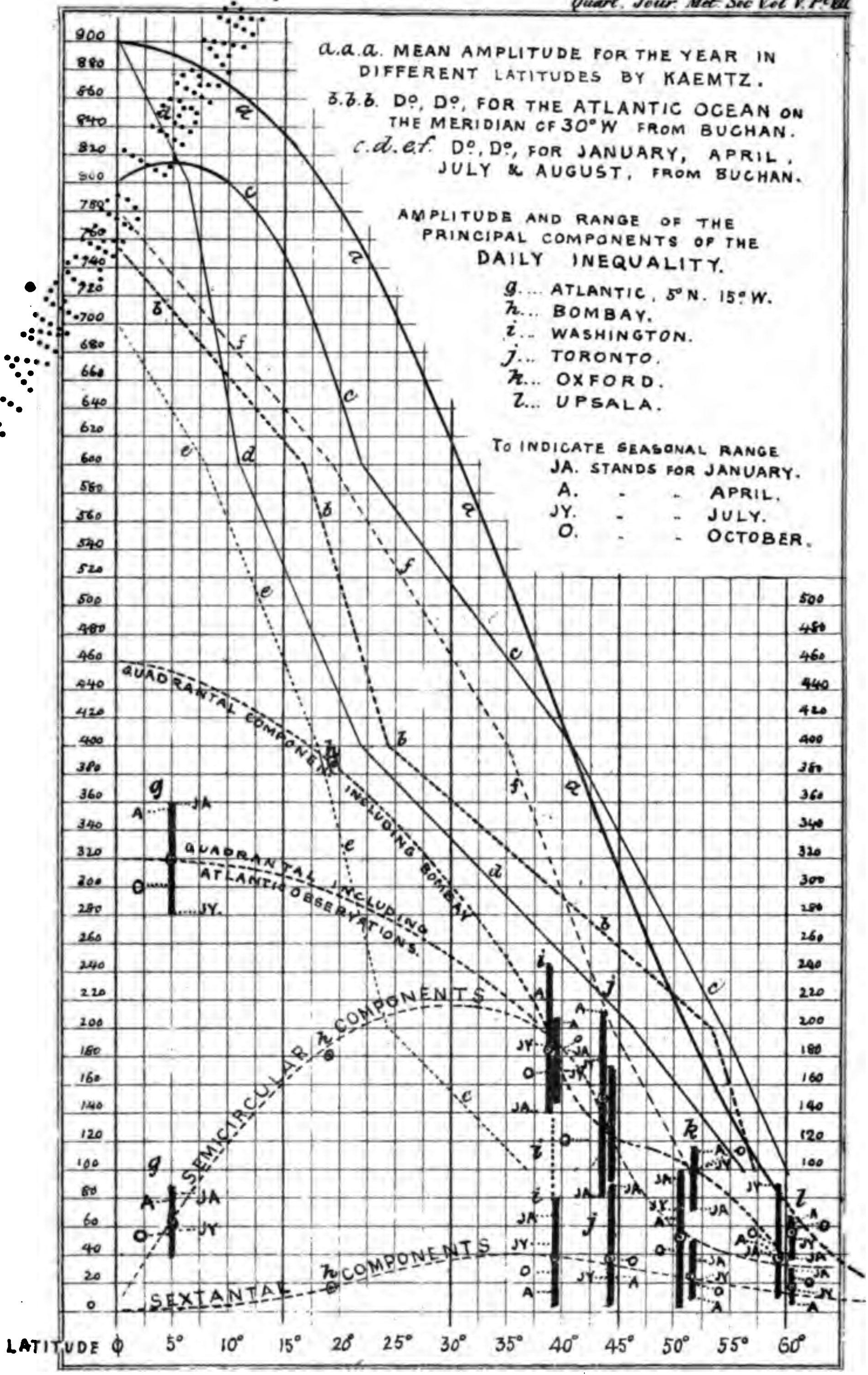

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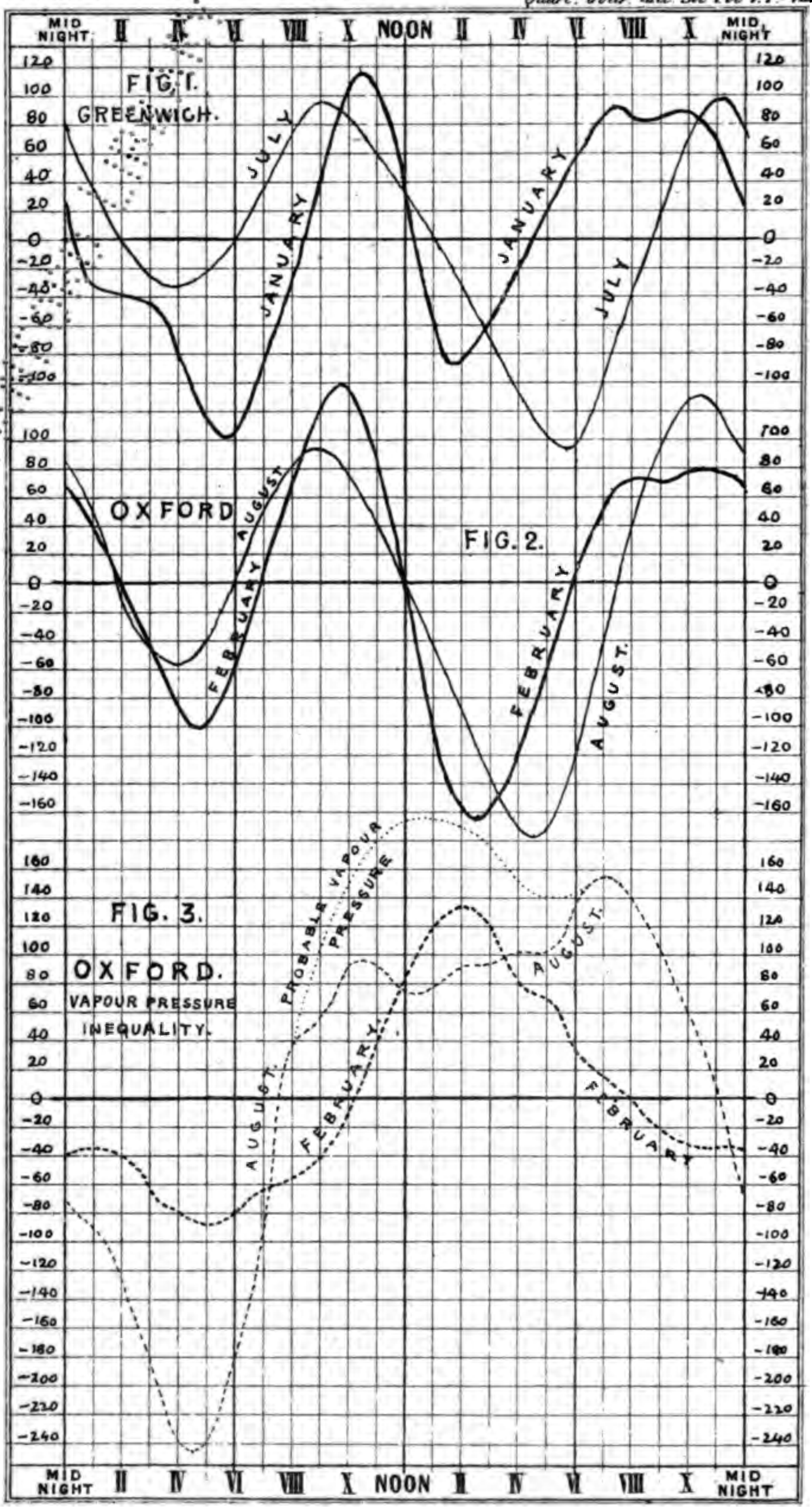

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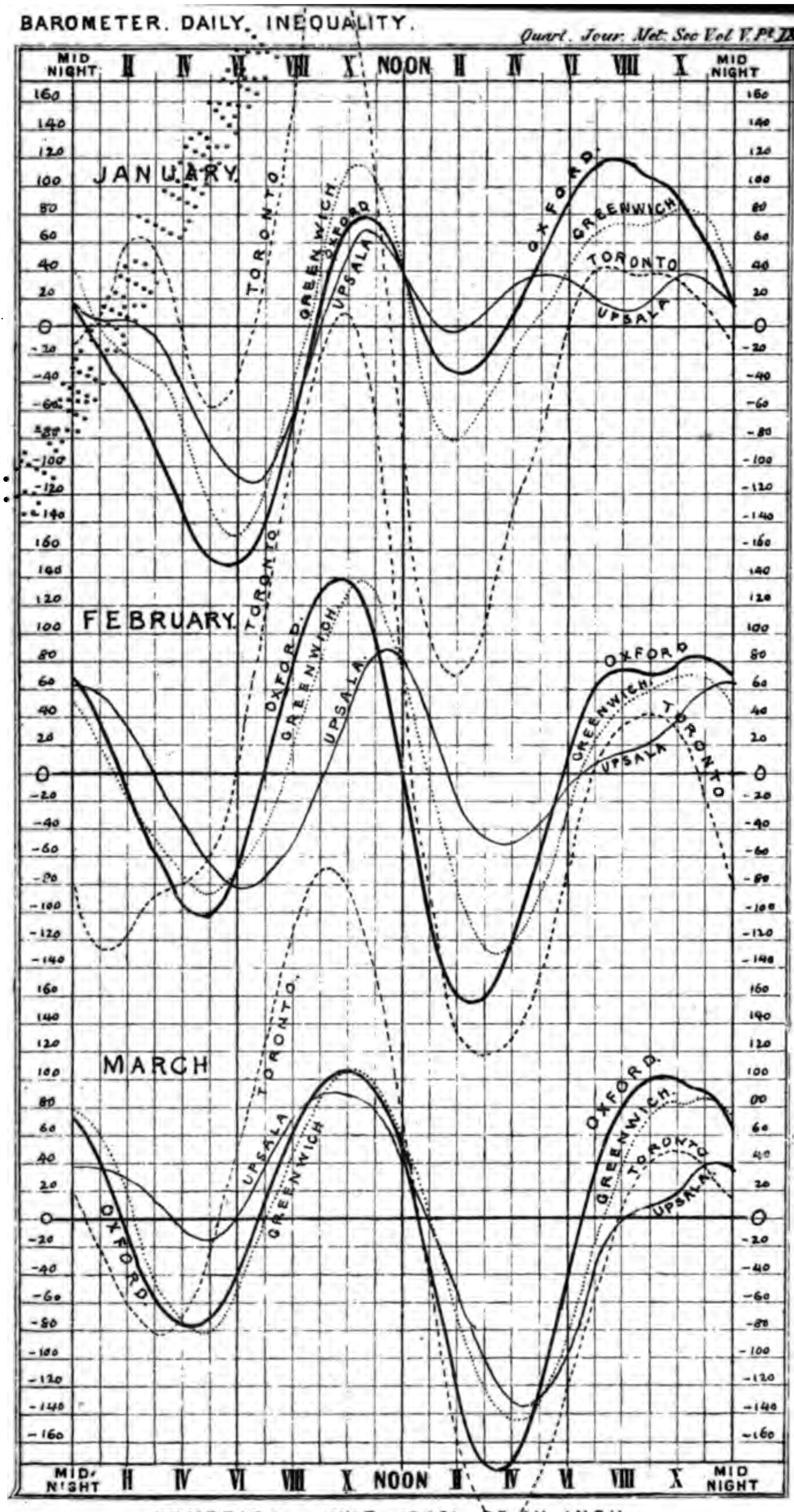

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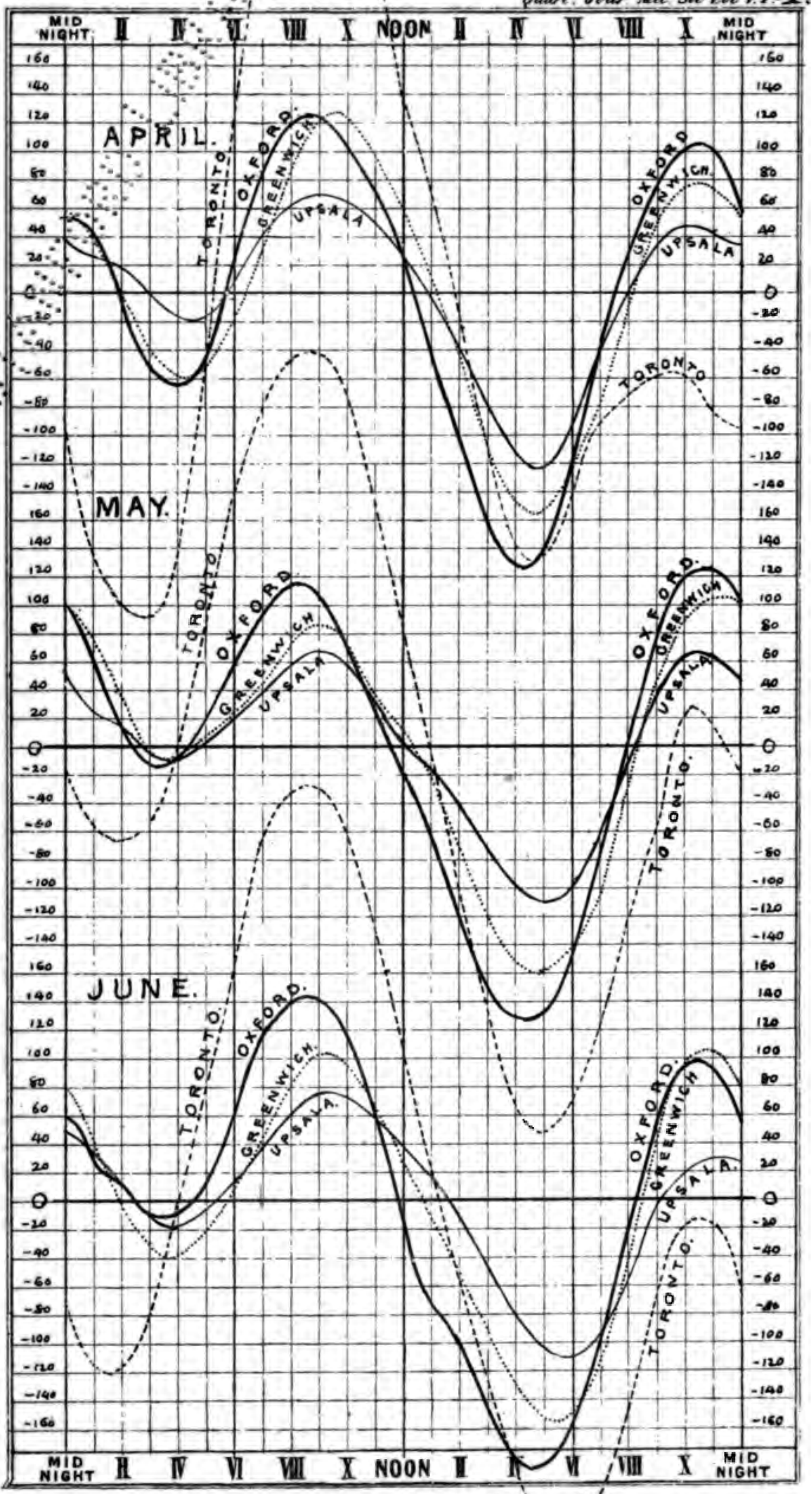

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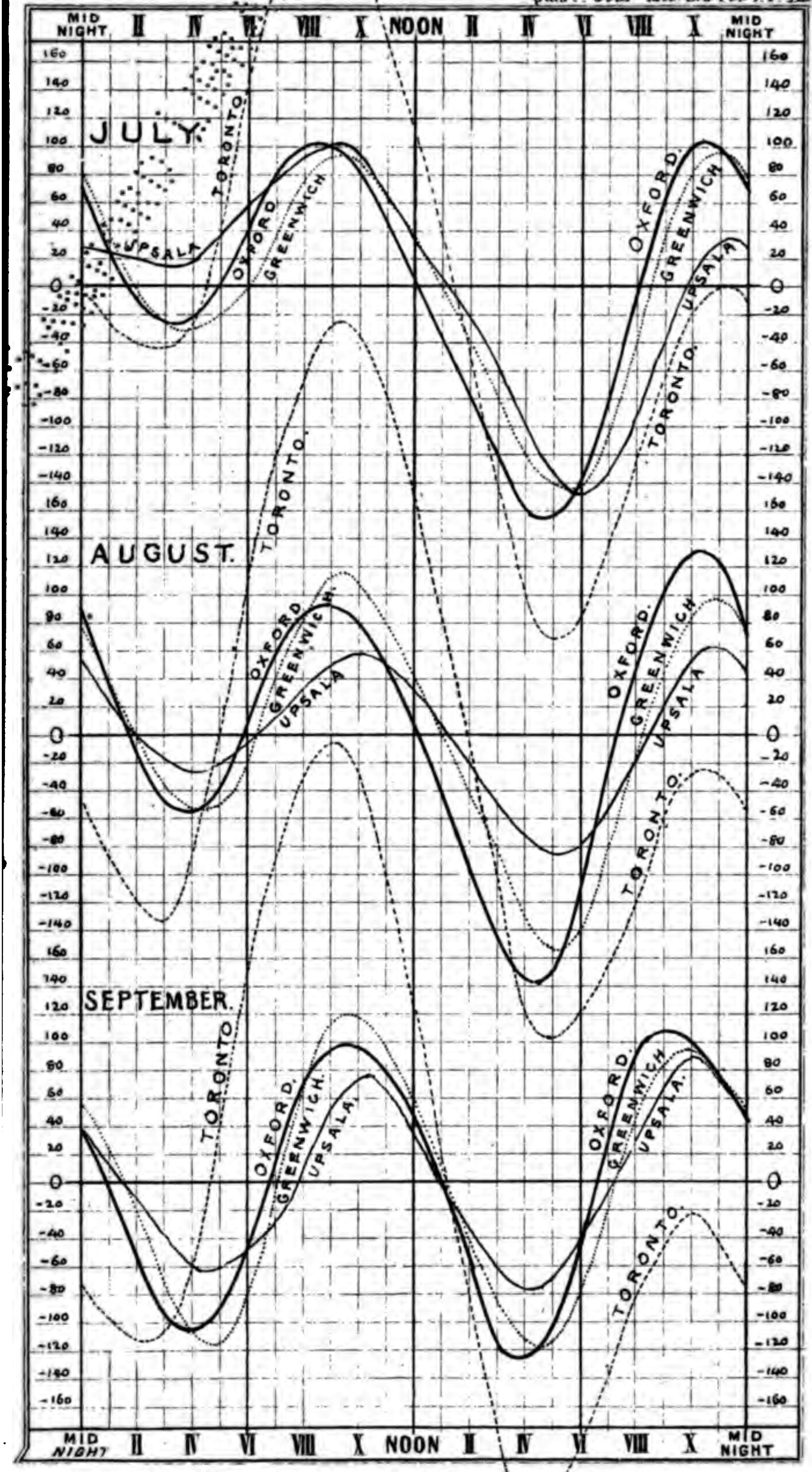

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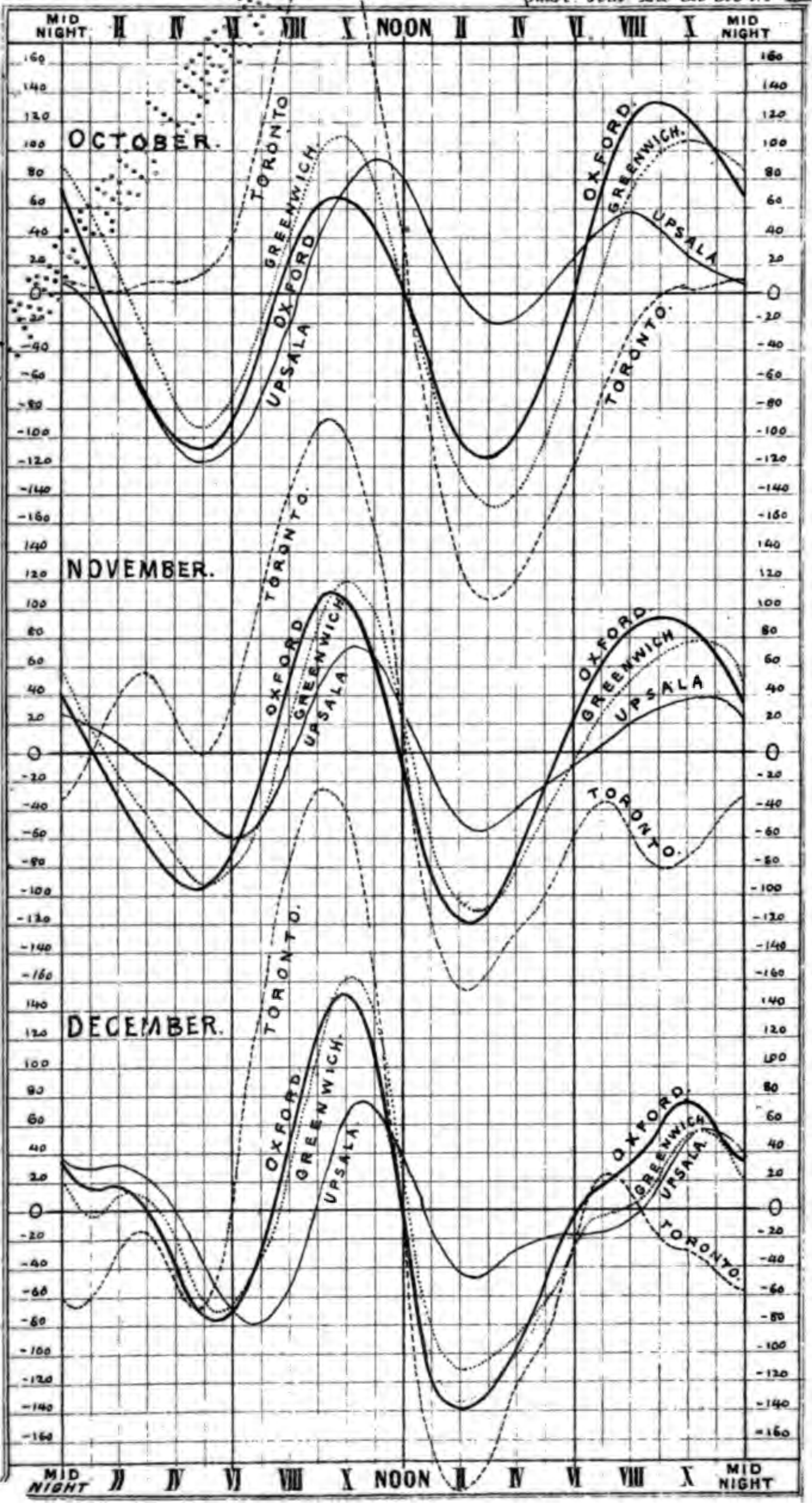

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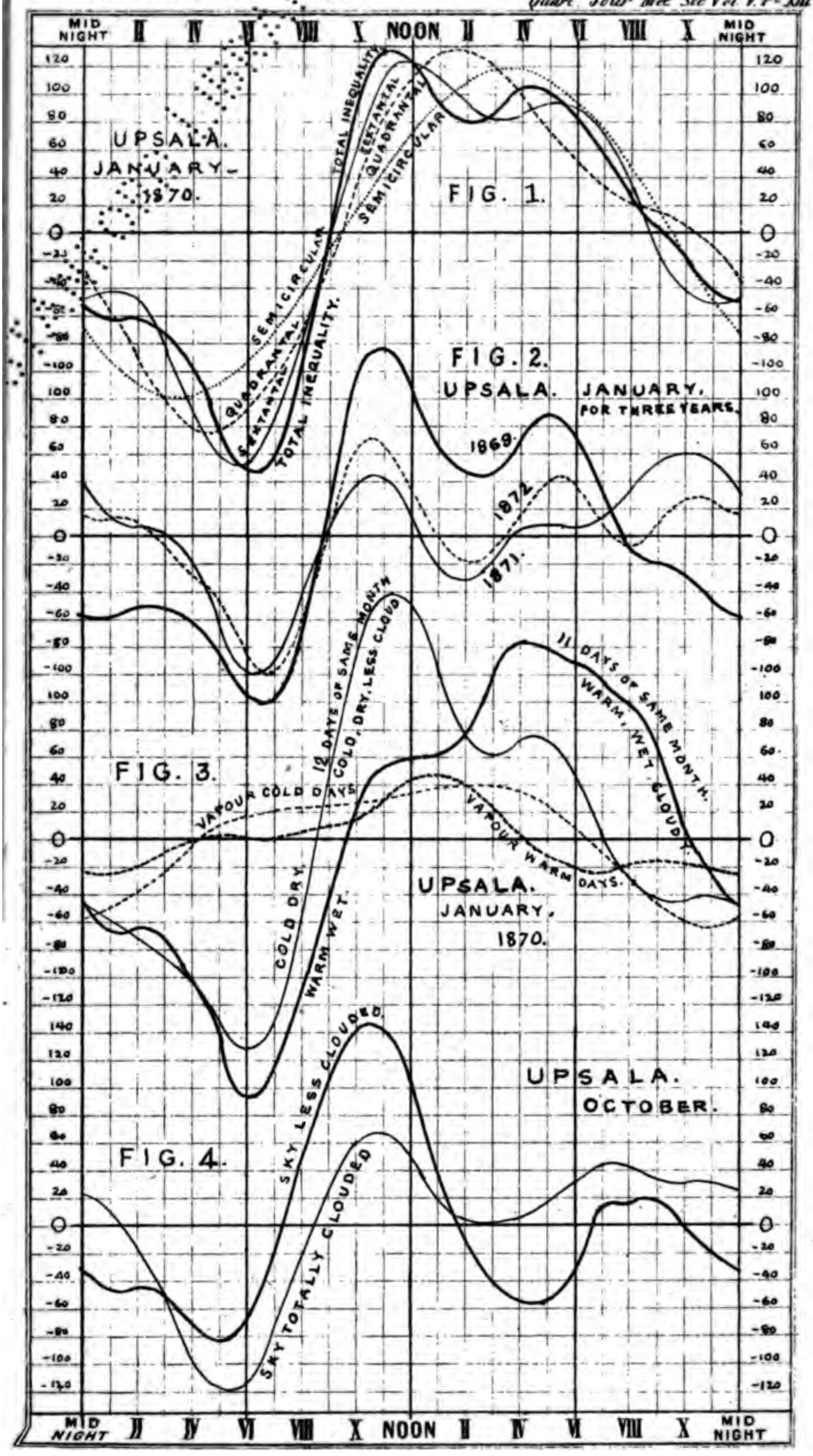

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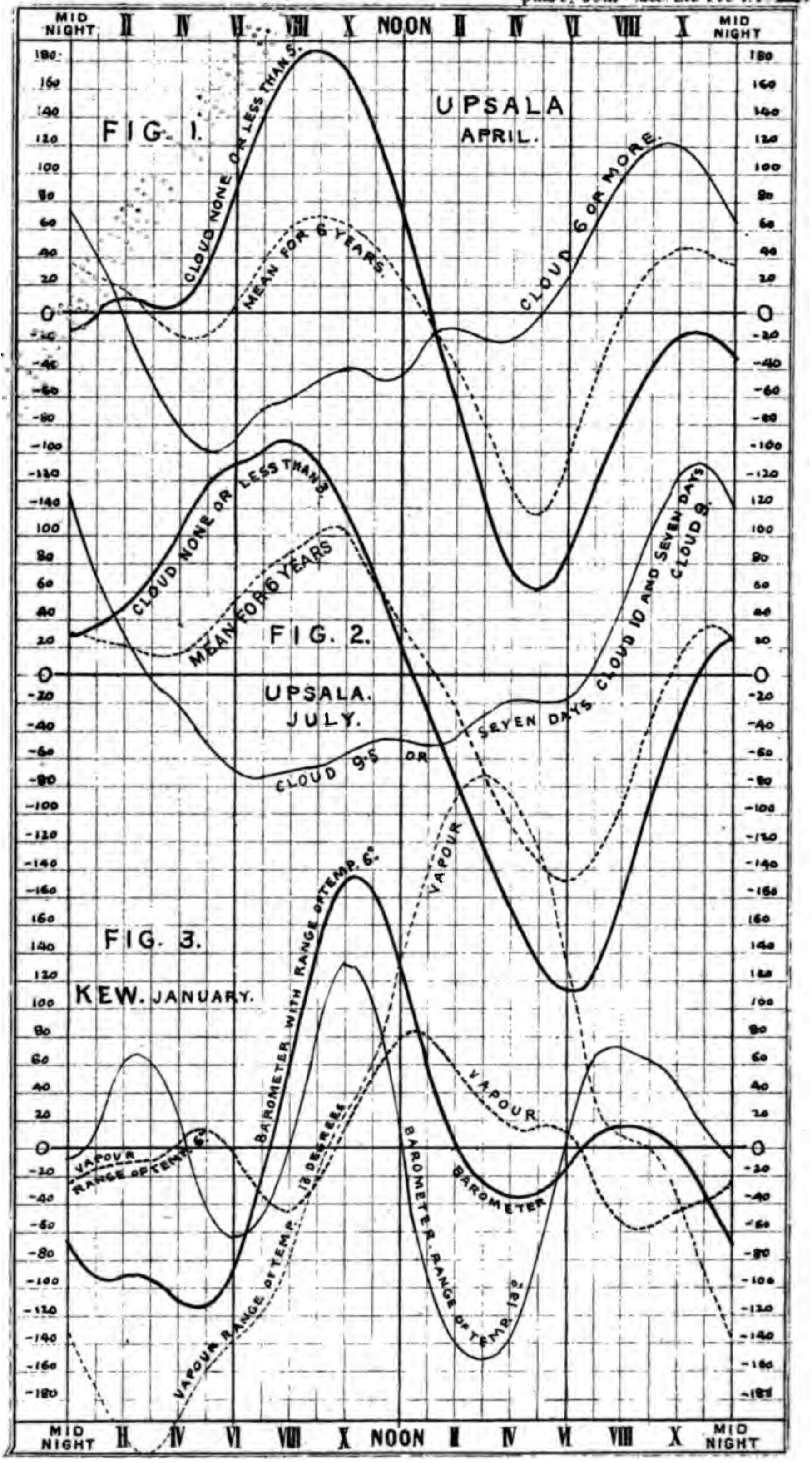

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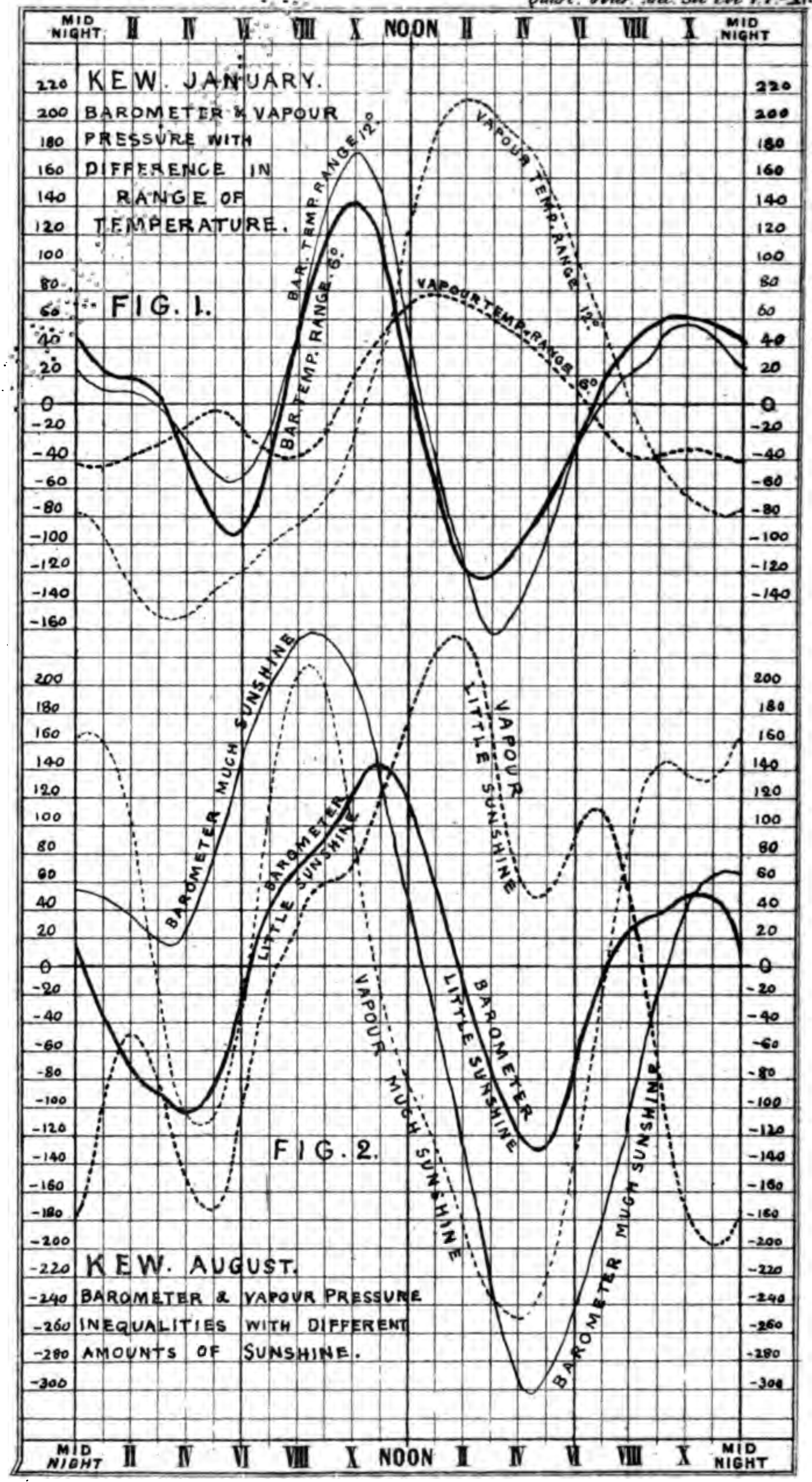

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QUARTERLY JOURNAL

OF

THE METEOROLOGICAL SOCIETY.

VOL. V. No. 29.

I. *The Daily Inequality of the Barometer.* By W. W. RUNDELL, F.M.S. (Plates I. to XV.)

[Received March 16th.—Read May 15th, 1878.—Revised January, 1879.]

IT requires some courage to ask your attention to a topic which has been so often, and at times so laboriously discussed, and hitherto with so imperfect a result. As illustrating the great labour which has been given to this subject, perhaps no better example can be named than the voluminous essay by the elder Peltier. It is printed in the 18th volume of the transactions of the Académie Royale de Bruxelles. The author quotes nearly two hundred authorities, and apparently accumulates data on the subject from every available source; yet the theory which he wrote to support, that the oscillation of the barometer is due to the different electrical condition of the upper and lower as compared with the middle layers of the atmosphere, now finds no support. Herschel, in his elementary treatise on Meteorology, does not even name this writer, but he possibly alludes to his theory when, speaking of electricity (section 187), he says, in italics, '*as a cause of winds or any atmospheric movements not merely molecular, we attribute to it no importance whatever.*'

Taking warning by this example, a small space only will here be given to theory, and no attempt will be made to finish the still imperfect discussion. My object will rather be to offer for your consideration what appear to me some new facts, to place some old ones in a new light, and to show how much work and the kind of work which must yet be done before even a moderately complete view of the subject can be obtained.

Mr. Ellis, in his recent paper* on the daily oscillation of the barometer at Greenwich, recalls attention to a part of the subject which in some of its aspects deserves more attention than it has yet received: the movement of what are termed the tropical hours with the season of the year. The diagram on Plate I. will illustrate this movement in our own latitude. The whole horizontal space, as indicated by the figures at top and bottom, represents a complete day. Against each month of the year, placed vertically, are drawn dark lines to show the hours of the day during which the barometer is rising, the white spaces connecting the dark horizontal lines showing the hours during which the barometer is falling. A glance is sufficient to show throughout the year two dark and two white spaces in each twenty-four hours, and that the white spaces, or those representing the fall of the barometer, vary most uniformly with the length of the day or night. Thus the white spaces in the summer afternoon are about twice as long as they are in the winter afternoon, like the length of the day; and the white spaces in the winter night are in like manner about twice as long as they are in the summer night.

---

* Quarterly Journal of the Met. Soc., Vol, III., p. 467.

There are several lines placed nearly close together against each month, so as to show the variations in the phenomena at different places in the same latitude. The uppermost dark line against each month is for Halle, as recorded by Kämtz; the next line against each month is from the mean of 16 years' observations at the Radcliffe Observatory, Oxford. The next is from the 20 years' means at Greenwich, from Mr. Ellis's paper; the next is also for Greenwich for a less number of years, as given by Mr. Glaisher, and the fine lines are from calculated data for Oxford and Greenwich, which will be referred to in another part of this paper.

The dark vertical curved lines show the time of sunrise and sunset for the middle of each month, and the shaded portions running parallel with the times of sunrise and sunset indicate the hours during which the barometer is rising throughout the year, and define more clearly the changing part of the phenomena.

This diagram favours the idea that the movement of the tropical hours would more closely and uniformly correspond with the length of the day if the means of a large number of years could be obtained, and if the effect of local influences could be estimated and separated from the result. Similar changes with the change in the length of the day, in other words, with change of latitude, but with characteristic variations in the details, have been observed in all records of the daily inequality of the barometer which have been consulted, as well for places in the southern as in the northern hemisphere. Professor Forbes, in his Second Report to the British Association in 1832, remarks that the hours of maxima are further apart from noon in spring and summer than in autumn and winter, and that the amount of the oscillation of both diurnal periods diminishes regularly through the seasons from spring to winter, and that this statement "seems probable for all parts of the globe so far as existing observations guide us." It is evident from the diagram that considerable local differences exist, even in places so near to each other as Greenwich and Oxford, and these differences become more apparent when the daily inequality is analysed in the usual way by the application of Bessel's formula.

The most striking feature of the daily inequality is undoubtedly the double maximum and minimum which is exhibited so regularly in low latitudes, and which shows itself with equal persistence in high latitudes like our own when the means of only a few days' observations are properly taken. In still higher latitudes the double maximum is sometimes obscured by the preponderance of the semi-diurnal oscillation, in a manner which has not perhaps been sufficiently explained. For example, when the semi-diurnal is about four or more times larger than the quarter-day or quadrantal term, the latter is concealed by it, and the daily barometric curve shows only one principal maximum and one minimum. This occasional concealment of the double oscillation is likely to mislead those who study tropical hours only, and do not separate the essentially different parts of the daily inequality from each other.

A thoroughly distinct conception of the three chief elements of the daily inequality of the barometer seems so necessary to a proper understanding of our subject, that it is desirable to enlarge a little on this really elementary part of the study of recurring phenomena. They are, briefly:

First.—The polar or semicircular component. It completes its period, that is, goes through all its *plus* and *minus* values, in twenty-four hours, and has one maximum and one minimum, exactly twelve hours distant from each other. If we represent the twenty-four hours of the day by the spaces lying between twenty-five dots, placed in a horizontal line as A B, fig. 1, divided in halves at C, and through the points A C B draw the curve of sines A M^1 C M B, the part of the curve above the horizontal line will bound *plus* polar values, and the part below the line will bound similar *minus* polar values. The maximum polar value M M and the similar minimum polar value M^1 M' will be exactly six hours distant from the nodal points A, C and B, and the sums of any number of similarly spaced lines drawn from the line A C to the curve A M^1 C parallel to M^1 M^1, and a similar number of similarly spaced lines drawn from the line C B to the curve C M B, will be exactly the same. The *plus* and *minus* values thus exactly balance each other, and do not affect the mean value of the barometer readings for the whole twenty-four hours. Any of these supposed lines will be equal to each other if they are at equal distances from a node, and this is the case whatever be the values of the maximum and minimum; that is, the same relations hold good whether the maxima and minima are of large or small value. From the nature of the curve, it also follows that from any two of the supposed lines taken exactly six hours apart the values of the maxima or minima can be easily obtained, and also the value of any other line whose position is known. The lines or values on each side of M M, M^1 M^1, diminish in the same way that the sines of angles diminish from 90° to 0°, equal distances along the line A B representing equal angles, and the whole line representing 360°, or 15° to

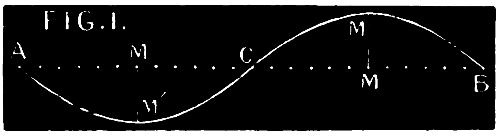
FIG. 1.

each hour. It must not be supposed that the nodes A, C, B, in fig. 1, represent 0, 12 and 24 hours, as the nodes of the semicircular or polar component may occur at any hour, and it thus becomes necessary to define in some way their position or distance from 0 hours, or midnight, or some other defined time. Usually it is convenient to give the polar values for midnight and for six hours afterwards, and from these the polar values for any other hours may always be obtained. In speaking of the polar angle, it will be convenient for our present purpose to define it as the distance of the first node from midnight, whether the node be an ascending node, that is, one where the values are going from *minus* to *plus*, or a descending node, that is, where the values are going from *plus* to *minus*.

Second.—The quarter of a day or quadrantal component, distinguished by two equal maxima and two similar minima, each at three hours' distance from the nearest nodal points, is represented in fig. 2.

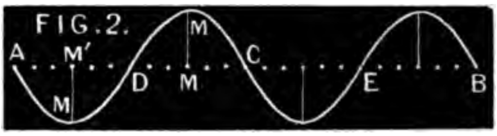
FIG. 2.

The quadrantal component bears exactly the same relation to the half day that the semicircular component does to the whole day; it therefore goes through all its *plus* and *minus* values in twelve hours, or twice as fast, and is consequently said to vary as the sine of "twice the angle" instead of directly as the sine of the angle, as in the case of the semicircular component; for instead of calling the half day 360°, as might at first appear necessary, it is convenient to retain the 360° as the measure of the twenty-four hours.

Third.—The sextantal component has three maxima and three minima of equal value in the twenty-four hours, occurring always at two hours from a nodal point, as represented in fig. 3.

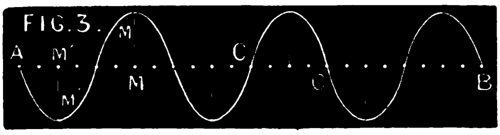
FIG. 3.

This component, it will be observed, goes through all its *plus* and *minus* values in eight hours, or three times as fast as the first component, and may properly be described as the one which varies as the sine of "three times the angle" for reasons similar to those given in the last paragraph but one.

In the same way that all values of the semicircular component can be ascertained if the values at any two given times six hours apart are known, so all that is necessary for determining quadrantal values for any hour of the day is to have two values at any two given times three hours apart; or for sextantal values, two known values at given times two hours apart, and so on for any smaller components which may have an aliquot number of periods in the twenty-four hours. Examples of these values are given in the columns headed "cos" and "sin" in the Tables, pages 26, 27, &c.

The quadrantal angle and the sextantal angle will for the present purpose be understood to mean the distance from midnight of their first nodal points.

It may be as well to state, before going into any further details respecting the three principal components of the daily barometric inequality, that no mixture or addition of semicircular components having different polar angles, that is, having their nodes and their maxima or minima at different hours of the day, can be made to produce anything but a semicircular component. No mixture of quadrantal components can form anything but another quadrantal component, and no mixture of sextantal components anything but a sextantal one, with this addition, that equal and similar components may be so placed as to entirely cancel out or mutually destroy each other. Were this not clearly stated, the student might be led to place a wrong construction on a statement which is sometimes made, that a combination of a curve of dry atmospheric pressure having one maximum and one minimum with a curve of vapour pressure having one maximum and one minimum, may give rise to a curve of barometric pressure having two maxima and two minima. If there were no quadrantal component included in one or both of the curves in question, there could be no quadrantal curve produced by their combination.

The monthly values of the semicircular component of the daily inequality in this country, as illustrated by the analysis of the Oxford and Greenwich observations, are not so regular in their seasonal changes as might have been expected from the long series of years from which they were obtained, and some discussion of the probable cause of this will be necessary. To give a better view of the seasonal change in this part of the inequality, we group with the Oxford and Greenwich values, in the following table, the values for some other places in different latitudes. See Table No. 1.

This table shows that the summer values for places north of the Tropics are greater than those for winter, and that the equinoctial values hold a somewhat intermediate position. Further, if from the observed mean monthly values by an application of the method of least squares we calculate the most probable values for each month, it will be found that the Greenwich and Oxford values for the winter and more stormy months of the year are probably abnormal. The calculated values have been included in the table. The differences between the observed and calculated values are also greater at the more northerly and more stormy stations. Here in fact we have one of the cases to which Bessel alludes, where the calculated values, by bringing the observations into the briefest and most complete form, enable us to see more clearly than do the observations themselves what theory is called upon to explain.

To complete the last table another is necessary, to show the seasonal change in the angle of the semicircular component, or the polar angle. Table 2 exhibits this change. The observed angles are taken out by inspection from the curves, or from the observations themselves, to the nearest tenth of an hour, and the calculated values are obtained directly from these. The uncertainties in the value of the components cause a corresponding uncertainty in the angles. It is, however, clear that the seasonal range in the

TABLE 1.

Semicircular or Polar Components of the Daily Barometric Inequality, in units of ·0001 of an inch.

Months.	Tropics Atlantic. 5° N. 25° W.	Bombay. 18° 54′ N. 72° 48′ E.		Washington. 38° 51′ N. 77° 0 W.	Toronto. 43° 39′ N. 79° 25′ W.	Greenwich.* 51° 29′ N.		Oxford.* 51° 46′ N. 1° 16′ W.		Upsala.* 59° 55′ N. 17° 40′ E.	
		From Obsn.	Calculated.			From Obsn.	Calculated.	From Obsn.	Calculated.	From Obsn.	Calculated.
January	81	204†	204	139	78	53	12	93	31	42	34
February	68	230	223	164	109	8	9	29	29	20	12
March	84	260	265	247	106	32	29	37	37	56	41
April	68	280	284	219	213	53	57	67	68	47	60
May	51	242	229	214	193	79	70	99	99	50	45
June	36	117	129	208	202	61	69	98	99	50	56
July	59	81	78	187	182	56	64	72	75	88	74
August	80	95	90	238	182	52	45	60	55	29	40
September ..	64	135	143	228	185	8	16	5	47	10	20
October	52	201	196	170	122	44	23	46	38	50	32
November	55	213	209	148	116	15	21	24	29	6	6
December	86	201	204	96	95	26	23	29	29	15	13
Arithmetical Means	65	188	188	188	149	41	37	55	53	39	36
Mean of Nov., Dec., Jan., and Feb. ..	73	212	210	137	100	26	16	44	30	21	16
Mean of May, June, July, and Aug. ..	57	134	132	212	190	62	62	82	82	54	54
Mean of Mar., and April..	76	270	275	233	160	43	43	52	53	52	51
Mean of Sept., and Oct. ..	58	168	170	199	154	26	20	26	43	30	26
Mean of 4 equinoctial months ..	67	214	223	216	157	34	31	39	48	41	38

* The Greenwich calculated semicircular components are the resultants from the most probable cosine and sine values, calculated directly from the original cosine and sine values (Table 8) without altering them in any way. The Greenwich cosine values as thus obtained are represented by the following equation: $C_0 = 12 - 3 \cos \theta + 2 \sin \theta - 7 \cos 2\theta - 7 \sin 2\theta + 1 \cos 3\theta + 6 \sin 3\theta$, and the sine values by the following:

$$S_0 = 26 - 33 \cos \theta + 20 \sin \theta - 8 \cos 2\theta + 6 \sin 2\theta - 10 \cos 3\theta - 9 \sin 3\theta$$

The resultant $\sqrt{C_0^2 + S_0^2} = 12 =$ semicircular component for the middle of January, when $\theta = 0°$. The months are supposed to be each equal to 30°, and to obtain C_1 and S_1, C_2 and S_2, &c., for February and March, &c., the angle θ must be made equal to 30°, 60°, &c.

For Bombay the calculated semicircular components are obtained directly from the cosine and sine values obtained by Mr. Chambers from the observations, without any alteration. The equations for the cosine and sine values are:—

$$C_0 = -84 + 4 \cos \theta - 21 \sin \theta + 3 \cos 2\theta - 3 \sin 2\theta - 3 \cos 3\theta + 6 \sin 3\theta$$
$$S_0 = 164 + 71 \cos \theta + 35 \sin \theta - 59 \cos 2\theta - 11 \sin 2\theta + 8 \cos 3\theta - 1 \sin 3\theta$$

It will be seen that when the polar angle varies in the different months so much as it does with this component, the mode here adopted for obtaining the most probable monthly values is more satisfactory than any attempt to obtain them by the direct application of the method of least squares to the resultants of the original cosine and sine values.

This last mode was applied to the original Oxford semicircular values, after modifying the values for the months of January, September and October, these not being thought

TABLE 2.

Polar Angle or distance from midnight of first node of the semicircular component of the Daily Barometric Inequality, in hours and tenths.

Months.	Greenwich.*		Oxford.*			Upsala.*		Mean of four Calculations.
	By Inspection.	By Calculation.	By Inspection.	By Calculation. 1	By Calculation. 2	By Inspection.	By Calculation.	
	hours.	hours.	hours.	hours.	hours.	hours.	hours.	hours.
January ..	1·3	0·3	0·0	4·7	5·17	—0·5	1·8	2·99
February ..	1·3	5·2	8·5	6·1	7·24	2·6	4·7	5·31
March	10·1	7·7	8·5	7·9	9·17	11·8	8·7	8·37
April	12·0	11·2	10·4	9·9	10·17	11·0	12·2	10·87
May	11·3	12·1	10·0	11·3	10·33	10·6	13·5	11·81
June	11·3	11·6	11·0	11·3	10·44	12·1	12·9	11·44
July	11·7	11·5	10·6	10·3	10·21	12·5	10·2	10·55
August	11·5	12·2	9·2	8·1	8·74	11·2	6·3	8·86
September..	13·5	12·5	6·8	6·3	6·17	5·3	5·7	7·67
October	11·4	10·2	3·6	4·9	3·93	—2·0	3·8	5·71
November ..	5·3	5·7	3·7	4·1	3·15	5·5	2·1	3·35
December ..	—0·2	1·4	8·7	4·1	3·70	5·0	1·7	2·73
Means	8·4	8·3	7·6	7·4	7·37	7·1	7·0	7·47
Range	13·7	12·2	10·6	7·2	7·27	14·5	11·8	9·08

* The calculated angles for Greenwich are obtained from the following equation, in which the polar angle reckoned in hours for the middle of January =

$$H_0 = 8{\cdot}3 - 5{\cdot}6 \cos\theta + {\cdot}5 \sin\theta - 2{\cdot}4 \cos 2\theta + {\cdot}7 \sin 2\theta.$$

The first calculated values for Oxford are from

$$H_0 = 7{\cdot}4 - 2{\cdot}7 \cos\theta + 2{\cdot}5 \sin\theta - {\cdot}3 \sin 2\theta$$

The second calculated values, for Oxford, are from

$$H_0 = 7{\cdot}37 - 2{\cdot}38 \cos\theta + 2{\cdot}95 \sin\theta + {\cdot}32 \cos 2\theta + {\cdot}53 \sin 2\theta - {\cdot}14 \cos 3\theta - {\cdot}17 \sin 3\theta$$

The calculated values for Upsala are from

$$H_0 = 7{\cdot}0 - 4{\cdot}2 \cos\theta + 4{\cdot}2 \sin\theta - 1{\cdot}0 \cos 2\theta - {\cdot}4 \sin 2\theta$$

These angles can only be considered as roughly approximate; the third pair of terms is omitted in three of the above equations; its value for Upsala was large, as may be inferred from the great irregularity of the nodal angles taken out by inspection, and leads to the inquiry how far these apparently abnormal values indicate physical peculiarities belonging to Oxford and other stations.

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to have equal weight with those for the other nine months. It was sought to retain as nearly as possible the values for the other months, and this end it will be seen has been moderately well attained. The figures in the calculated column for Oxford were obtained from the following equation, in which the Oxford semicircular component is made $= 53 - 28 \cos\theta + 17 \sin\theta - 13 \sin 2\theta + 6 \cos 3\theta + 2 \sin 3\theta$.

For Upsala the calculated semicircular components are obtained directly from the cosine and sine values derived from the observations, without any alteration whatever. The equations for the cosine and sine values are as follows:—

$$C_0 = 3 + 3 \cos\theta + 6 \sin\theta - 1 \cos 2\theta + 5 \cos 3\theta - 8 \sin 3\theta$$

$$S_0 = 17 - 33 \cos\theta + 31 \sin\theta + 4 \cos 2\theta - 6 \sin 2\theta - 20 \cos 3\theta - 13 \sin 3\theta$$

The units as stated at the head of the Table are ·0001 of an inch of mercury.

† This column has been added as this Paper was going to press, and the observation values are from the recent volume by Charles Chambers, F.R.S., on the Meteorology of Bombay. It will be seen by reference to this important work that the polar Barometric inequality does not so much depend on the absolute temperature as on the range of temperature, and that the range varies inversely with the amount of cloud.

polar angle is at least seven or eight hours, and may be so much as twelve hours or 180° in our latitude.

A general view of the range both in value and angle of the semicircular component is given for Oxford on Plate No. II. The large observed value for January, and the small observed value for September, are strongly contrasted by the dotted and calculated lines in this diagram.

Here another consideration presents itself. The semicircular component is no doubt frequently simulated by the larger movements of the barometer, and especially by the sudden depressions which accompany some of the cyclonic movements of the atmosphere. A glance through the Quarterly Weather Reports of the Meteorological Committee, or the diagrams which appear weekly in the 'Times' for the Kew Observatory, will readily afford instances of this. As an example, take from the Quarterly Weather Report (Part 8, 1874) the movement of the barometer at Aberdeen on the 21st October, 1874.[*] Here the semicircular co-efficient for one day amounts to ·395 of an inch, or thirty times the apparent excess for January, a quantity large enough to affect the average value and angle of this component, not only for the month, but for several years. There can be no question that such a day as this should be eliminated when a correct estimate of a daily recurring phenomenon is desired, and we are led to believe that for such a purpose as we have now before us a more correct result might be obtained by taking selected days from a comparatively small number of years. Taking from the published observations for Kew for four years, sixty days in January, when the movement of the barometer was less than two-tenths of an inch, the observed semicircular component came out as 88, which very closely corresponds with our calculated value for Oxford. Again, taking 122 selected days from six Januarys at Upsala, when the movement of the barometer was less than six millimetres, the mean value is 44, that for the whole of the 186 days being 42. Here the difference between the calculated value (84) and the observed value (42) is therefore due to some constant physical peculiarity, and not to the cause which has now been suggested.

Another cause of error, though comparatively a small one, if the means for a long period be taken, may be named in this context. It not unfrequently happens that the month ends or begins with a higher value than the mean, so that the monthly mean for 0 hour does not correspond with the monthly mean for 23 hour. Thus in the Greenwich values for the month of November the value at midnight is 48 units[†] greater than at 11 p.m., while the general form of the barometric curve would make a less value probable. In the same way, in the Teneriffe observations at Guagara, where the means

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[*] The inequality for this day is represented by

$$b_0 = \cdot 1037 \cos\theta - \cdot 3805 \sin\theta + \cdot 0126 \cos 2\theta + \cdot 0032 \sin 2\theta + \cdot 0001 \cos 3\theta + \cdot 0019 \sin 3\theta + \cdot 0012 \cos 4\theta - \cdot 0020 \sin 4\theta + \cdot 0002 \cos 6\theta - \cdot 0012 \sin 6\theta$$

Where b_0 stands for the inequality at 0 hours and $\theta = 0°$,—for the other hours b_1, b_2, b_3, &c., the angle θ becomes 15°, 30°, 45°, &c.

[†] The unit is ·0001 of an inch.

of only a few days are available, the proposed correction for daily oscillation of the barometer is made more than twenty times as much for the difference between 5 a.m. and 6 a.m. than it is for the adjacent hours, entirely through there having been a constant rise in the barometer during the days on which the hourly observations were made; and as the hour at which the daily tabulation commenced happened to be 6 a.m., a considerable error is thus introduced. Another example has recently come to my notice in the daily inequality of the barometer at Polaris Bay and Polaris House, 81° 36′ N. lat., 62° 15′ W. long., where the difference between 11 p.m. and midnight is so much as 240 of our units *plus*, while the calculated difference is less than one-tenth of this amount *minus*. The diagram (Fig. 1, Plate III.) will exhibit and explain this last example, and show what is meant by the term "error from obliquity." Its existence may also be seen in the following hourly differences between the calculated and observed inequality for November at Greenwich, commencing at and going on regularly from 0 to 23 hours, civil time:— + 35, + 25, + 30, + 17, + 15, + 23, + 12, + 11, + 15, 0, 0, + 8, — 6, — 6, — 6, — 8, — 10, — 14, — 14, — 17, — 27, — 19, — 34, — 36.

The error from *obliquity*, so far as it affects the semicircular component of the daily inequality, is one-sixth of the total obliquity, and frequently becomes an important element when the means of only a few days have to be dealt with.

These considerations, if in some measure applicable to the high values of the semicircular component for the month of January, and equally to the low values for September at Oxford, will scarcely meet the whole of the case. To say the least, it is singular that Greenwich, Oxford, and Upsala should all agree in giving the very small value to September shown in Table 1.— Upsala one-fourth, Greenwich one-sixth, and Oxford less than one-tenth of the mean values for the months of August and October on either side of it. In seeking for some further explanation for this last peculiarity one is reminded of the remark by Herschel that the characteristic feature of the daily inequality is probably due, as suggested by Dove, to the mutual destruction of the semicircular components of the curves of vapour pressure and dry air. Accepting this view of the matter, we are brought to look at the daily barometric inequality merely as the resultant arising from their joint action, and to conclude that, from local peculiarities, at these places the semicircular components of the dry air and vapour pressures are so nearly equal in amount and opposite in direction as to nearly "mutually destroy" each other.

Reference to the next diagrams will show that this is really the case. Figs. 2 and 3, Plate III., exhibit the curves of dry and vapour pressure for January and September at Oxford, and also the resultant curves of the total barometric inequality. Figs. 1 and 2, Plate IV., exhibit the semicircular components of the same curves. These last show that in January the vapour pressure preponderates, and that, though both are small, as the similar nodes are only five hours twenty-five minutes apart, both curves conspire to produce a large resultant. While in September, though both curves are very much larger than in January, the nodes are almost exactly twelve hours apart, and we have as the resultant merely the difference of the two curves.

These examples show that to properly appreciate the seasonal changes in the components of the daily barometric inequality, it is necessary to view them in connexion with the seasonal changes in the vapour pressure. In this place, however, it will be sufficient to state that the daily semicircular inequality for vapour pressure, though much larger in amount and greater in range with change of season than the resultant semicircular inequality which we have so far considered, has only a very limited range of angle, as its mean polar angle for any month does not vary more than half-an-hour from the mean polar angle for the year. This is a strong contrast to the polar angle of the resultant semicircular barometric inequality, which, as we have already seen, may perhaps vary in some months so much as six hours from its annual mean.

Before passing on to the next component, it seems desirable to say a word on the unit which has been adopted in the preceding table, and which will be retained throughout the paper.

It may be thought that by adopting ·0001 of an inch of mercury as our unit, we are dealing with a very minute quantity, seeing that few barometers can be read to less than ·002 of an inch. Here the defect lies with the instrument rather than with the value of the unit, and arises from our measuring air by comparison with a body which is more than 10,000 times heavier than itself. There can be little doubt that meteorologists would be glad to use smaller units if it were practicable, but in cases like the present we are dealing not with a single reading of the barometer, but with the means of many readings. Supposing the daily observations were only made correctly to hundredths of an inch, the monthly means might fairly be calculated to thousandths, and the means of these for periods of years might fairly be taken to ten-thousandths, and the analysis of these means to four places of decimals of an inch in height of mercury shows very satisfactorily that to this extent we are dealing with real and well-defined quantities. As a familiar illustration, it may be said the ·0001 of an inch of mercury represents a film of water of the thickness of tissue paper, or a layer of air at the ordinary temperature and pressure of one inch thickness (1·0518 inch), or a weight of one ounce on every square yard.

Speaking more definitely, the following figures may be adopted. With an atmospheric pressure of 14·7 lbs. on the square inch, the mercury of specific gravity 13·596 at 29·922 inches, or water at 33·9 feet, we have,

·0001 inch of Barometer = ·3438 grains per square inch,
= 49·5104 grains per square foot,
= 445·5937 grains per square yard,
or equal to ·0637 lbs., or 1·0185 ounces per square yard.

In proceeding to the quadrantal component of the daily barometric inequality, we begin to tread on surer ground. There may still be some uncertainty, but the probable errors in amount are comparatively small, so that more extended observations will modify only, and are not likely to materially change, the results which have already been obtained. As regards the quadrantal angle also, any uncertainty is brought within narrow bounds, as the whole mean seasonal range is well within an hour. In fact, the seasonal range of this component, both as regards amount and angle, is remarkable for its regularity. This is not only well shown by the long averages of the Greenwich and Oxford observations, but is supported by the observations for comparatively short periods made at other places. Details of this part of the inequality are given in Tables 3 and 4.

The larger values for Oxford as compared with Greenwich are no doubt to a great extent due to those causes which distinguish the meteorology of inland stations from those which are near the coast. The effect of difference in this respect is unmistakably shown by Mr. Buchan in Part I. of his very laborious and comprehensive essay.* The promised discussion of the various causes of these differences in Part II. has been anxiously waited for by those meteorologists who take interest in this curious inequality.

These causes of difference may probably be summed up as belonging to differences of temperature and difference of range in temperature, differences in relative humidity and in range and kind of vapour pressure, relative amount of cloud and sunshine, and the whole of these as modified by latitude and by prevalent winds. Some of the remarkable changes connected with cloud and sunshine, free radiation and free absorption of heat, will be given further on. Here it is only desired to view the quadrantal inequality as resulting from the similar inequalities in the pressures of dry air and vapour. The various ways in which these combine to produce what will always be considered the chief feature of the daily barometric inequality is fully exhibited in the diagrams for the Oxford observations given on Plate V.

It was pointed out in reference to the semicircular component of the inequality, that while the resultant polar angle varied greatly with the change of season, the polar angle for vapour pressure changed very little. With the quadrantal angles the reverse of this takes place. Here the resultant angle for vapour pressure will be observed to change through several hours in the course of the year, while the resultant barometric angle varies very slightly. It is singular, however, that the comparatively uniform value of the quadrantal inequality is due sometimes to the arithmetical sum and sometimes to the arithmetical difference of the rather widely varying dry air and vapour inequalities.

Possibly this is not everywhere the case, and the small values for the barometric inequality at Valentia, Helston, and Helder, to which Mr. Buchan has called attention, may arise from a uniform difference of six hours, or nearly six hours, in the quadrantal angles of the dry air and vapour pressures, as well as from the small range of temperature at these places.

The quadrantal angle varies so little that the equation of time becomes a considerable factor in its composition, and where the observations are regulated by hours of mean time a correction should be made. There seems

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* Transactions of the Royal Society of Edinburgh, vol. XXVII, page 397.

TABLE 3.

Quadrantal Component of the Daily Barometric Inequality, in units of ·0001 of an inch.

Months.	Tropics. 5° N. 25° W.	Washington. 18° 51′ N. 77°·0 W.	Toronto. 43°·39′ N. 79°·25′ W.		Greenwich. 51°·29′ N.		Oxford. 51°·46′ N. 1°·16′ W.		Upsala. 59°·55′ N. 17°·40′ E.	
			From Obsn.	Calculated.	From Obsn.	Calculated.	From Obsn.	Calculated.	From Obsn.	Calculated.
January	360	190	118	136	74	78	67	80	35	43
February	327	184	171	153	98	98	109	96	55	55
March	333	200	149	164	105	108	115	113	64	62
April	354	209	170	162	101	99	113	114	61	64
May	334	149	127	134	82	87	98	103	55	56
June	293	146	113	107	89	82	96	93	55	52
July	280	167	110	112	82	86	86	93	50	53
August	285	163	132	133	97	96	108	97	55	60
September....	314	160	141	133	102	108	109	102	70	65
October	302	190	114	111	106	107	101	104	59	61
November	348	192	88	96	87	89	93	95	45	45
December	341	179	132	113	75	69	86	82	43	35
Arithmetical Means	323	177	130	130	92	92	98	98	54	54
Mean of Nov., Dec., Jan., Feb.	344	186	127	125	84	84	89	88	45	45
Mean of May, June, July, Aug.	298	156	121	122	88	88	97	97	54	55
Mean of March, April	344	205	160	163	103	104	114	114	63	63
Mean of Sept., Oct.	308	175	128	122	104	108	105	103	65	63
Mean of 4 Equinoctial Months	326	190	144	143	104	106	110	108	64	63

The calculated quadrantal components for each month are the resultants derived directly from the cosine and sine values obtained from the original figures without any alteration.

Those from Toronto are from

$C_0 = 23 - 23 \cos \theta + 7 \sin \theta - 2 \cos 2\theta + 13 \sin 2\theta - 5 \cos 3\theta + 2 \sin 3\theta$
$S_0 = 126 + 12 \cos \theta + 19 \sin \theta - 8 \cos 2\theta + 19 \sin 2\theta + 8 \cos 3\theta - 6 \sin 3\theta$

Those for Greenwich are from

$C_0 = 56 - 11 \cos \theta + 8 \sin \theta + 5 \cos 2\theta + 10 \sin 2\theta - 3 \cos 3\theta$
$S_0 = 72 + 5 \cos \theta - 6 \sin \theta - 10 \cos 2\theta + 8 \sin 2\theta - 1 \cos 3\theta + 5 \sin 3\theta$

Those for Oxford are from

$C_0 = 37 - 5 \cos \theta + 5 \sin \theta - 6 \sin 2\theta + 2 \cos 3\theta - 6 \sin 3\theta$
$S_0 = 90 - 2 \cos \theta + 3 \sin \theta - 12 \cos 2\theta + 8 \sin 2\theta - 4 \cos 3\theta + 2 \sin 3\theta$

Those for Upsala are from

$C_0 = 40 - 1 \cos \theta + 1 \sin \theta + 3 \cos 2\theta + 6 \sin 2\theta + 4 \cos 3\theta + 33 \sin 3\theta$
$S_0 - = - 34 + 10 \cos \theta - 2 \sin \theta + 16 \cos 2\theta - 5 \sin 2\theta + 1 \cos 3\theta + 1 \sin 3\theta$

TABLE 4.

Quadrantal Angle or distance from midnight of first node of the quadrantal component of the daily Barometric Inequality, in degrees, and corrected for Equation of Time.

Months.	Greenwich.		Oxford.		Upsala.	
	By Inspection.	By Calculation.	By Inspection.	By Calculation.	By Inspection.	By Calculation.
	19°·0±	19°·0±	10°·0±	10°·0±	26°±	26°±
January	−7·2	−7·5	−5·4	−5·3	+11·6	+12·3
February	−5·0	−4·3	−5·5	−5·2	+ 5·5	+ 5·7
March	−0·5	−0·3	−2·2	−2·3	− 7·2	− 5·8
April	+3·1	+3·1	+2·0	+1·6	− 8·0	− 9·8
May	+3·7	+3·7	+3·9	+3·8	− 6·1	− 4·4
June	+3·5	+3·4	+3·0	+3·3	+ 1·0	+ 1·1
July	+4·2	+3·5	+0·6	+1·5	+ 1·6	+ 1·3
August	+2·6	+2·2	−1·1	+0·8	− 1·9	− 1·3
September	+2·9	+2·3	+2·2	+1·3	− 4·8	− 3·4
October	−0·7	+0·9	+1·5	+1·9	− 1·5	− 3·8
November	−1·6	−1·7	+0·7	+0·8	− 2·3	0
December	−5·1	−5·4	−4·0	−4·3	+ 9·0	+ 8·1
Means	19·0	19·0	10·0	10·0	26·0	26·0
Range	11·2	11·2	9·4	9·1	19·6	22·1

The quadrantal angles expressed in degrees are as follows :—

For Greenwich—correction for equation of time included—

$H_o = 19 - 5 \cos \theta + {\cdot}8 \sin \theta - 2 \cos 2\theta - {\cdot}5 \cos 3\theta - {\cdot}3 \sin 3\theta$

For Oxford

$H_o = 10 - 2{\cdot}9 \cos \theta + 1{\cdot}6 \sin \theta$, and correction for equation of time

For Upsala

$H_o = 26 + 4 \cos \theta - 2 \sin \theta + 6{\cdot}8 \cos 2\theta - 1{\cdot}4 \sin 2\theta + 1{\cdot}5 \cos 3\theta + 1 \sin 3\theta$

no adequate reason for keeping to mean time in reading off the records of automatic instruments, as it would be quite as easy for the copying clerk to adjust his reading scale to "apparent time." This was long since proposed for the stations under the control of the Meteorological Committee, and must be desired by all meteorologists who have entered on the discussion of periodic phenomena. In the introduction to the very careful discussion of the barometric observations at Batavia, Dr. P. A. Bergsma pointedly says:—"The annual variation of the diurnal variation of the barometric pressure cannot be accurately deduced from observations made at hours of mean time. For these researches the observations should be made at the hours of apparent time. The same is applicable to the study of all the phenomena of the atmosphere and of terrestrial magnetism."

A remarkable difference in the mean quadrantal angles for Greenwich and Oxford must be noticed. (See Table 4.) The quadrantal inequality is not only larger at Oxford, but its phases occur there more than half-an-hour earlier than at Greenwich. What is the physical cause of this undoubted difference of time, and the earlier appearance of the phenomena at the more westerly station? How can it be explained by those who suppose it necessary that an overflow of air should take place from the east towards the west in connection with the change of form in the semi-diurnal atmospheric wave?

The third of the three principal components of the daily inequality of the barometer, the sextantal component, to which we now advance, has its own special interest. (See Table 5.) To it is chiefly due the seasonal movement in the tropical hours, which is shown in the first diagram. It is largest in winter, but has a second maximum in summer, and at the equinoxes almost entirely disappears in this country. At the equinoxes, too, a sudden change takes place in the sextantal angle (see Table 6), and it will be observed that this change in the angle has a great influence not only on the movement of the tropical hours, but also in extending or contracting the period during which the barometer is rising, especially in the evening. The upper part of Plate VI. exhibits the sextantal curves as the resultants of the dry air and vapour components of the same name.

The monthly values of this inequality for Washington, Toronto, Greenwich, Oxford, and Upsala are given in the table. Against the observed values are given others which have been calculated in a somewhat empirical way from them. These are inserted with the calculated values obtained in the ordinary way. Like the figures in the last table, these show a reasonably close agreement with the values directly derived from the observations, and prove that we may be fairly satisfied with the results already obtained as affording a trustworthy general view of the natures of the second and third components.

The effect of the sextantal component in changing the tropical hours depends as much on its angle as on its amount. This may be illustrated by another reference to the first diagram, where the light lines immediately below the dark ones represent the tropical hours derived from the recalculated values of the inequality for each month at Greenwich. It will be seen that the lines for the months of October and November extend to near midnight, and that the line for December reaches beyond midnight. A moderate change in the sextantal angle without any change in the value of the sextantal components would make the hours accord more nearly with the tropical hours of the months of January and February. The effect of this change of angle on the December curve at Greenwich is shown on the lower part of Plate VI.

Here the December curve is the calculated one, having its tropical hours represented by the lowermost but one line for December in Plate I., and the same curve (Plate VI.) is shown so as to represent successive additions of one hour to the sextantal angle, without making any change whatever in the values of the three components from which the curve is constructed. The curves are successively numbered 0, 1, 2, 3, 4, 5, 6, 7 ; at 0 they would of course again run through the same series.

The effect of these changes is also shown in the first diagram of the tropical hours, Plate I., for the curve 2 by dots, for the curve 4 by short vertical strokes, and for the curve 6 by small circles.

The action of the sextantal component in changing the form of the general curve is well exhibited in this diagram, and must be borne in mind when we come to inspect the differences exhibited by the curves for the same month in different years.

TABLE 5.

Sextantal Component* of the Daily Barometric Inequality, in units of ·0001 of an inch.

Months.	Washington 38° 51′ N. 77° 0′ W.			Toronto. 43° 39′ N. 79° 25′ W.				Greenwich. 51° 29′ N.				Oxford. 51° 46′ N. 1° 16′ W.				Upsala. 59° 55′ N. 17° 40′ E.			
	From Obs.	Calculated.		From Obs.	Calculated.			From Obs.	Calculated.			From Obs.	Calculated.			From Obs.	Calculated.		
			1			1	2			1	2			1	2			1	2
		—15±	or		—18±	or	or		—11±	or	or		—11±	or	or		—8±	or	or
January	69	—60	75	91	—65	83	80	46	—39	50	43	37	—35	46	44	28	—19	27	30
February	57	—45	60	50	—38	56	56	34	—27	38	30	47	—31	42	42	22	—16	24	26
March	33	—13	28	18	4	14	20	13	— 5	16	9	24	—12	23	22	14	— 4	12	14
April	14	28	13	23	38	20	19	3	16	5	10	7	16	5	6	6	12	4	7
May	49	57	42	28	50	32	33	18	28	17	18	25	36	25	25	12	22	14	11
June	30	59	44	39	52	34	34	23	36	25	24	21	35	24	25	14	24	16	16
July	44	44	29	27	49	31	29	21	37	26	28	21	29	18	17	17	23	15	16
August	10	29	14	18	36	18	21	14	25	14	16	15	21	10	16	5	14	6	8
September ..	5	13	2	8	10	8	2	7	5	6	5	8	10	1	9	6	— 2	10	9
October	28	—13	28	41	—22	30	32	30	—14	25	24	17	—10	21	21	25	—16	24	23
November	49	—41	56	68	—48	66	67	36	—26	37	35	37	—26	37	36	23	—20	28	27
December	79	—59	74	75	—66	84	87	46	—36	47	43	44	—33	44	42	28	—18	26	28
Mean	39	..	39	41	..	40	40	24	..	26	24	25	..	25	25	17	..	17	18
Mean of Nov., Dec., Jan., Feb.	64	..	66	71	..	72	73	41	..	43	38	41	..	42	41	25	..	26	28
Mean of May, June, July, Aug.	33	..	32	28	..	29	29	19	..	21	22	21	..	19	21	12	..	13	13
Mean of Mar. and April .	24	..	21	21	..	17	20	8	..	11	10	16	..	14	14	10	..	8	11
Mean of Sep., and Oct. ..	17	..	15	25	..	19	17	19	..	16	15	13	..	11	15	16	..	17	16
Mean of 4 Equinoctial Months	20	..	18	23	..	18	18	13	..	13	12	14	..	13	15	13	..	13	13

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* Two modes of recalculating this component have been tried. They both agree very closely in their results, though it must be allowed that the second mode is to be most depended upon. By the first it is supposed that nodes occur near the equinoxes, which divide the winter from the summer values: the winter values were treated as all *minus*, and the summer values as all *plus*, and from these the most probable values were directly obtained in the usual manner.

By this mode the sextantal components for each month were derived from the following equations:—

For Washington from

$$W_0 = -15 - 55 \cos \theta + 21 \sin \theta - 8 \cos 2\theta - 5 \sin 2\theta + 3 \cos 3\theta$$

For Toronto from

$$T_0 = -18 - 55 \cos \theta + 27 \sin \theta - 8 \cos 2\theta + 4 \sin 2\theta - 2 \cos 3\theta - 3 \sin 3\theta$$

For Greenwich from

$$G_0 = -11 - 36 \cos \theta + 13 \sin \theta - 1 \cos 2\theta - 2 \cos 3\theta - 2 \sin 3\theta.$$

For Oxford from

$$O_0 = -11 - 35 \cos \theta + 11 \sin \theta - 3 \cos 2\theta - 4 \sin 2\theta + 3 \cos 3\theta - 2 \cos 3\theta$$

For Upsala from

$$U_0 = -8 - 21 \cos \theta + 11 \sin \theta + 2 \cos 2\theta - 2 \sin 2\theta - 3 \sin 3\theta$$

The second method is that which is adopted with the other components, by which

TABLE 6.

Sextantal Angle or distance from Midnight of first node of the Sextantal Component of the Daily Barometric Inequality, in degrees.

	Greenwich.*		Oxford.*		Upsala.*	
	By Inspection.	By Calculation.	By Inspection.	By Calculation.	By Inspection.	By Calculation.
	32°±	32°±	33°±	33°±	34°±	34°±
January	—28	—28	—34	—33	—29	—29
February	—23	—30	—22	—26	—25	—34
March	—22	— 6	— 8	— 7	—19	—12
April	+34	+25	+15	+17	+23	+20
May	+37	+38	+33	+35	+32	+32
June	+39	+42	+42	+40	+38	+36
July	+40	+44	+34	+35	+37	+43
August	+43	+24	+25	+24	+34	+32
September	—29	—16	+ 2	+ 1	—13	— 6
October	—31	—41	—18	—19	—28	—34
November	—31	—32	—34	—33	—25	—30
December	—30	—20	—35	—34	—26	—18
Means	32	32	33	33	34	34
Range	74	85	77	74	67	77

The special function of the sextantal component, which has now been illustrated, does not appear to have been previously noticed by writers on this subject.

It may be added that the octantal component of the daily inequality also shows considerable regularity in its changes, though it is not necessary here to trace the details of a term of this small order. It certainly assists the sextantal term in producing the seasonal changes in the tropical hours.

The seasonal differences of each of the three principal components are so marked that they cannot escape attention. Their several peculiarities may be the resultants for each month are obtained from the cosine and sine values directly derived from the original figures. These are expressed for

Toronto by

$$C_0 = 6 - 2\cos\theta + 1\sin\theta - 8\sin 2\theta - 1\cos 3\theta - 8\sin 3\theta$$
$$S_0 = 18 + 55\cos\theta - 22\sin\theta + 8\cos 2\theta - 5\sin 2\theta - 1\cos 3\theta$$

For Greenwich by

$$C_0 = 12\cos\theta + 2\cos 2\theta - 4\sin 2\theta - 2\cos 3\theta - 2\sin 3\theta$$
$$S_0 = 8 + 30\cos\theta - 15\sin\theta + 1\cos 2\theta - 2\sin 2\theta + 2\cos 3\theta + 2\sin 3\theta$$

For Oxford by

$$C_0 = 1 - 4\cos\theta + 6\sin\theta + 1\cos 2\theta - 8\sin 2\theta + 1\cos 3\theta + 3\sin 3\theta$$
$$S_0 = 11 + 33\cos\theta - 9\sin\theta + 3\cos 2\theta + 1\sin 2\theta - 3\cos 3\theta + 4\sin 3\theta$$

For Upsala by

$$C_0 = -3 - 9\cos\theta + 2\sin\theta + 4\cos 2\theta - 4\sin 2\theta$$
$$S_0 = 8 + 20\cos\theta - 10\sin\theta + 1\cos 3\theta + 3\sin 3\theta$$

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* Greenwich Sextantal Angle in degrees =

$$H_0 = 32 - 34\cos\theta + 23\sin\theta + 8\cos 2\theta - 8\sin 2\theta - 2\cos 3\theta - 10\sin 3\theta$$

Oxford Sextantal Angle =

$$H_0 = 33 - 36\cos\theta + 16\sin\theta + 1\cos 2\theta - 2\sin 2\theta + 2\cos 3\theta - 2\sin 3\theta$$

Upsala Sextantal Angle =

$$H_0 = 34 - 35\cos\theta + 16\sin\theta + 7\cos 2\theta - 6\sin 2\theta - 1\cos 3\theta - 11\sin 3\theta.$$

thus described:—The semicircular component has generally a great range; its plus maximum occurs at northerly stations in summer, its minus maximum in winter; its angle varies greatly with the season of the year. The quadrantal co-efficient has a much smaller range, and has double maxima; the plus maxima occur at the equinoxes; the quadrantal angle has a small range. The sextantal co-efficient has also double maxima, but in this case the minus maxima occur at the equinoxes, and its winter plus maximum is larger than its summer plus maximum; its angular range is great, and changes with great rapidity at the time of the equinoxes.

These differences demonstrate the inutility of attempting to find any simple general expression for the amplitude of the diurnal oscillation, and will prepare one for finding that the attempts in this direction have not been very successful.

In the early part of this century it was supposed that the amplitude of the daily inequality varied as $\cos^2$ latitude multiplied by the ratio of the mean temperature at the place to the mean temperature at the equator. By using the centigrade scale for temperature a minus value is obtained for the inequality when the mean temperature becomes zero, or the freezing point for water. A change from *plus* to *minus* was considered to always occur in high latitudes, and Professor Forbes objects to a formula proposed by M. Hallström, on the ground that "it would give a positive oscillation at the pole, which would be impossible." At present we are led to believe that at the time of the equinoxes the oscillation would be plus in all latitudes, and we do not place so much importance on the change in angle in either of the co-efficients of the inequality, except so far as to try and find out its cause.

Professor Forbes* proposed the following formula, as expressing with great exactness the daily inequality, so far as his experience went. The numerals have been changed to units of an inch—Z is the amplitude of the oscillation, θ the latitude:—

$$Z = \cdot 1195 \cos^{\frac{3}{2}} \theta - \cdot 0150.$$

This it will be seen gives ·1048 for the mean value of the oscillation at the equator, and — ·0150 for its value at the pole, the change of signs occurring, as stated by Professor Forbes, about latitude 65°.

This part of the subject may be best illustrated by a diagram (see Plate No. VII.); in which the vertical scale represents the barometric inequality in units of ·0001 of an inch, and the horizontal scale shows degrees of latitude from 0 to 65°. The strong curve represents the amplitude of the daily oscillation, as given by Kämtz, and will serve also for Forbes. The lighter lines give the mean and seasonal values of the amplitude for the meridian of 30° W in the Atlantic, according to Mr. Buchan. This meridian having been selected as best adapted for comparison by the uniformity of its conditions. Below these lines are given the mean values and ranges of the three principal components of the daily barometric inequality for places already named in this paper, for Captain Toynbee's squares, and also the

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[*] Second Report on Meteorology to the British Association, 1832.

annual mean value of the three components for Bombay, as quoted by Mr. F. Chambers.

These examples are too few and too irregularly situated to warrant any attempt at an exact general expression for the three components; but, speaking very roughly, the semicircular component may be said to vary up to latitude 45° as sine $\frac{3}{2}$ latitude, and then to decrease somewhat irregularly in the higher latitudes. The quadrantal component may be roughly said to vary as $\cos^3$ latitude, and the sextantal component as $\cos^3 2$ latitude. These differences seem enough to show that no simple function of the latitude is likely to express the sum of the three components. The same inference may be made from the part of the diagram for which we are indebted to the first part of Mr. Buchan's paper.

Here the point chiefly insisted upon is the necessity for the separate consideration of the three principal components, in order to obtain a fair view of the daily barometric inequality. What has already been said may be deemed sufficient to justify this, but other considerations tending to the same conclusion will be apparent as we proceed.

Turning once more to Plate No. I., it will be observed that the shaded portions are made to indicate throughout the year a fixed time before and after sunrise, and before and after sunset. They are delineated about half-an-hour before sunrise, and about three and a half hours after sunrise. During the whole of this interval it will be seen that the barometer is rising continuously, and that in mid-winter the boundary line shows the time near which the mercury begins to continuously fall. At mid-summer, however, the mercury does not begin to fall until about three and a half hours later, or about seven hours after sunrise. Again, while the morning rise of the barometer begins about half-an-hour before sunrise at mid-summer, it begins nearly three hours before sunrise at mid-winter. How can these differences of time be explained in a phenomenon which is considered to depend so immediately upon the sun? Why does a change which shows itself three and a half hours after sunrise in winter when the temperature is low, be so delayed as to seem to require seven hours when the sun has more power and the temperature is high?

This feature in the diagram makes it necessary to discuss to some extent the theory of the diurnal inequality, or at least that part of it which relates to the mid-day fall of the barometer. Dr. Thomson, in his Introduction to Meteorology, says the explanation is not difficult, and adds, "As the air is rarefied by the increase of heat, the ascending current diminishes the statical pressure below, and the mercury falls; while the reverse of this takes place at the coldest part of the day,—the statical pressure being increased by the descending current of cold particles, and the mercury elevated. In those places where the double series of tidal waves is met with, Sabine explains one of them in this manner, and attributes the other to the influence of temperature upon the tension of aqueous vapour in the atmosphere, which will produce a similar result, but at different diurnal periods; that is, the maximum vaporic force will occur at the hottest, and the minimum at the coldest hour of the day. By the combination and converse action of those forces, the phenomena in question are produced." This statement and the details given by Sabine (Report British Association, 1845) respecting an overflow of the ascending current, and the difference in weight of the vertical column from want of accordance between the hypothetical overflow at the top and the actual inflow of air below during one part of the day and the reverse action in the evening, as experienced at Bombay, can, it is thought, be only partially accepted. It is easy to understand that an upward current of air will take off some of the pressure from a barometer placed beneath it, and that a descending current would in like manner increase the pressure upon the barometer, but it will be observed that the downward current, instead of occurring at the coldest part of the twenty-four hours, as stated by Dr. Thomson, appears to occur immediately the upward current fails, and to complete itself in nearly every case some time before midnight. The coldest part of the twenty-four hours as constantly occurs after midnight, and as a rule nearer to sunrise than to the preceding midnight. It is difficult to apply the theory of an overflow of air, which must of necessity have only a low velocity, to the explanation of a phenomenon which travels round the earth in the tropics at the rate of a thousand miles an hour. It seems, too, unnecessary to introduce the effect of land and sea breezes to account for the quadrantal part of the inequality in the pressure of dry air, to which Sabine makes reference, when this same feature is also very conspicuous at Oxford in the month of January, as shown in Fig. 2, Plate III., where there is no suspicion of a daily land and a sea breeze. It must also be remembered that far at sea in the midst of the trade winds the same daily inequality is most constant and conspicuous. As was remarked in my paper on the barometric observations at Mount Washington (Vol. II. p. 226), such theories seem to introduce unnecessary difficulties, and we shall do well to keep to our upward and downward current, and to the addition and subtraction of aqueous vapour to the same column of air, with the tensional effects which accompany it, until it is found necessary to introduce some additional cause for the explanation of the phenomena.

It is not intended to make objection to the usual explanation of the land and sea breeze so far as the lower strata of the air are concerned, but only to suggest that for our present purpose it is desirable to simplify our hypothesis by excluding for a time all idea of horizontal movement within the column of air, by supposing it to be surrounded for a long distance by similar columns of air under precisely similar conditions.

Our immediate object, however, is to seek for some reason why the midday fall of the barometer should be retarded for several hours in the hotter months of the year, as shown in Plate I., when one might expect any upward current to show itself earlier and be more vigorous. For it must be remembered that besides the delay in time, the upward velocity, if judged by the rate of fall in the barometer, is also much less. In Fig. 1, Plate VIII., the barometric curves for January and July from twenty years' observations at Greenwich are placed in contrast with each other to illustrate these remarks.

They show both parts of the phenomena so clearly as to make comment almost unnecessary. The case may be put thus: the sun in January apparently decreases the whole weight of the local atmosphere at Greenwich 192 units in three and a half hours; in July the sun appears to take eight hours to produce a similar change of 236 units. In January about midday, when the fall of the barometer is most rapid, the rate is 90 units in one hour; in July between one and two p.m., when the fall is most rapid, it is equal to 89 units only.

The following quotation from Mr. Glaisher's paper in the Transactions of the Royal Society (presented February, 1848) will readily suggest considerations which must enter into any satisfactory explanation of this part of the subject as well as of some other points which must presently be referred to :—

"When evaporation commences in the morning, with the increase of temperature the vapour seems to accumulate on the surface of the soil, till the air in its vicinity becomes heated and the daily ascending current of air commences. It seems likely that this stratum of vapour neither attains a great thickness nor spreads upwards until the ascending current takes place and that it ascends and spreads (*upwards*) as long as the ascending current continues.

"In summer time, between the hour of noon and that of the maximum temperature of the air, the temperature of the dew point remains nearly stationary, and the degree of humidity becomes less in value notwithstanding that evaporation is most rapid. It is evident, therefore, that all the water evaporated must at once pass upwards. The strength of the ascending current of air being at a maximum at the same time that the stream of vapour is the most rapid, it would seem that the rapidity of the motion of the latter is dependent on the former. Towards the evening hours, when the temperature of the air is decreasing rapidly, the ascending current will decrease in force, and ultimately cease altogether, giving place to the descending current of night; then the vapour again accumulates on the surface of the earth, not only from evaporation, but also from the vapours flowing down with the descending current; the air now nearly approaches to a state of saturation, and the degree of humidity of the air arrives at its maximum.

"Therefore there is a rapid increase of vapour and decrease of the degree of humidity during the day, and a rapid diminution of vapour and increase of the degree of humidity during the evening and night hours. These remarks are to be understood to apply to a point at the height of four feet only from the earth.

"At present I cannot give any information relative to the distribution of vapour at distances greater than four feet. However, from the fact that whilst evaporation is the most rapid, the air at the height of four feet becomes relatively drier than it would be in consequence of the increase of temperature alone, it is plain that much vapour must pass upwards.

"In the higher strata of the atmosphere the changes of temperature are less than in the lower strata; and at a point not very distant from the earth, but varying in different seasons, the temperature must be stationary during the twenty-four hours of the day; we may readily infer that at a certain point above the earth, the air becomes relatively more moist during the course of the day whilst the ascending current continues, and less so at night while the vapour flows downwards with the descending current, being exactly the reverse of the facts which take place at the height of four feet. At some certain point above the earth, the temperature of the dew point, like that of the air, must be stationary during the twenty-four hours of the day. Observations to determine the absolute quantity of water mixed the air, and the relative humidity at differen distances from the earth, are much needed."

Though all that part of this extract which relates to relative humidity is not immediately applicable to the present part of our topic, it is not thought desirable to curtail in any way Mr. Glaisher's very graphic description. Here we confine our attention to the effect of the increase and decrease of the vapour as it affects the barometer.

Now, taking the midday fall as chiefly due to the upward movement of the air, and as some index to its relative velocity, the late period for its commencement in summer as compared with the winter season may be due to the much larger quantity of vapour which is then being added to the atmosphere, and to the relatively slower movement of a greater mass. The added weight of vapour, due to the larger evaporation of surface water, having also absorbed much of the heat which in winter is expended in more suddenly expanding both the dry and humid parts of the atmosphere. The sun's rays in winter also probably meet fewer particles of water in the air, and have besides one-thirtieth more power than in summer through the less distance of the sun.

For reasons also glanced at by Mr. Glaisher in the above extract, we are unable to bring this explanation to a strictly numerical test, but the following rough approximation will probably suffice, as from the nature of the case the numbers must err on the side of deficiency rather than excess. The diagrams Nos. 2 and 3, Plate VIII., embody data supplied by the Oxford records for the months of February and August, and give the means of sixteen years' observations. No. 2 gives the inequality curve for the barometer, and No. 3 the inequality for vapour pressure only.

The following comparison may be made between the two months for the latitude of Oxford, say 52° N nearly:

February, middle of month, sunrise 7 h. 9 m. a.m. Declination 13° S.
Altitude of sun at noon = 38°—13° = 25°.
August, middle of month, sunrise 4 h. 46 m. a.m. Declination 14° N.
Altitude of sun at noon, 38° + 14° = 52°.

If the sun's heat at the respective noons be taken in the ratio of the sines of the respective altitudes, we have the proportion 42 : 79.

In February the barometer is rising briskly at sunrise, and continues to rise until 9h. 40m. a.m.=2h. 31m., the rise of the barometer during this time being represented by 116 units, it then falls until 2h. 25m. p.m., = 4h. 45m., and falls from + 138 to — 162, or 300 units in all, and at noon is falling at the rate of 110 units in an hour.

In August the barometer is just beginning to rise with the sun, and continues to rise until 8h. 50m. a.m.=4h. 4m., the rise being equal to 137 units; it then falls until 4h. 17m. p.m., equal to 7h. 27m., and falls from + 92 to — 175, or 267 units, at noon falling at the rate of 67 units in an hour. Combining these ratios we have $\frac{300}{4 \cdot 75} : \frac{267}{7 \cdot 45} = 63 \cdot 2 : 35 \cdot 7$ a result largely in favour of February and almost exactly in the inverse ratio of the sines of the sun's altitude at the chosen epochs.

Again in February, as will be seen by Fig. No. 3, Plate VIII, the weight of water added to the air in the 2h. 31m. between sunrise and 9h. 40m. a.m., when the barometer is at its maximum, is 40 units, and from this time to 12h. 25m. p.m., a space of 2h. 45m., the vapour pressure has increased by 120 units, or a total in 5h. 16m. of 160 units.

In August the weight of water added to the air in 2h. 31m. after sunrise is 220 units, and in the next 2h. 45m., or by 10h. 2m. a.m., by at least 130 units (and possibly more), thus giving a total in 5h. 16m. of 350 units.

This shows more work done in the same time in August as compared with February, and in a greater proportion than the sines of the sun's altitude at the two times. How are these curious and apparently opposite results to be worked into the explanation of the daily barometric inequality?

It was thought useless to carry the comparison for vapour pressure beyond the 5h. 16m. adopted above, owing to the great probability that exists that even before 10h. 2m. a.m. in August the differences of the dry and wet bulb thermometers have ceased to give satisfactory information respecting the weight of vapour in the air, and that after this hour the comparison of the two thermometers for this purpose is still more uncertain.

The ground for this doubt has already been referred to, and it will become perhaps more apparent by an inspection of the curves in Fig. 3, Plate IV. The vapour curves for the other summer months will be seen to resemble that for August in being truncated towards midday, as compared with the continuously upward curves of vapour pressure shown by the colder months of the year.

As already stated, only a very rough numerical comparison is here attempted.* Good numerical results may perhaps be possible when we have observations obtained by the aid of captive balloons kept for several weeks at a considerable height above the earth's surface. Meanwhile it only seems reasonable to suppose that in fine weather vapour is constantly being added to the air, rapidly up to the hottest part of the day, although, owing to the reduction in the available supply of moisture at the surface of the ground, it may not be so rapid after 10 or 11 a.m. as before it. If the midday fall of the barometer be admitted to be chiefly owing to the upward current of air and vapour, it is certain that the flow continues in summer very steadily up to five p.m., and gives no evidence of any check from lack of the lighter component to which much of the motion must be due.

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* Probably our leading meteorologists have long given up the idea that hygrometric observations, made near the earth's surface, afford any correct information respecting the weight of vapour in the local atmosphere. The data for vapour tension and weight of dry air which are still given in meteorological registers, are supposed to be taken at an assessed value or under reserve—or as useful for giving information respecting the *mean condition of* the surface stratum of air at the different places.

Different quantities of moisture are no doubt sent up with the heated air from different soils, from grass as compared with ploughed lands, from cornfields and woods, from marshy places and tracts covered with the refuse of mines and quarries. These separate streams of air and vapour with ever varying conditions, which affect the lower atmosphere chiefly, form aerial screens and curtains, and supply the reflecting surfaces for changing the direction and softening the influence of sound to which Professor Tyndall has alluded. We must all have experienced their effect, though we may not have recognised in them the cause of the stillness and quiet of the summer noon in the country.

The sufficiency of the upward and downward currents of air to produce the whole of this important part of the daily inequality, and one which is always observed under normal conditions, as at sea or on land where there are no mountains and valleys to modify this phenomena, is a fair subject for discussion. It may be argued that the upward movement of the heated portions of air necessarily implies the downward movement of colder and heavier portions to fill their places, and that the result of these movements will be a comparatively slow elevation of the centre of gravity of the column of air in which these motions are going on, and that the semicircular part of the inequality, at least, is thus nothing more than the daily heat-wave of the atmosphere, which is spoken of by Herschel in section 77A of his Meteorology. He estimates that the heat-wave due to a daily range of temperature of 20° Fahr. would raise the centre of gravity of the atmospheric column 726 feet, and says the dynamical effect of this on the barometer would not be sensible owing to the length of the period over which the movement is extended. This motion would, when most rapid, be represented by 94 feet in an hour.

The statical effect must not, however, be neglected. An elevation of the centre of gravity of the column of air of 726 feet would occasion a fall of ·00048 inch in the barometer at the base of the column. There would also be a further small effect due to centrifugal force. We may roughly estimate the effect per mile of elevation in this latitude due to decrease of gravity as ·00284 inch, and that due to difference of centrifugal force as ·0006 inch. These minute quantities seem to go only a small way towards the desired explanation, unless we suppose an elevation of the centre of gravity of the column so great as on other grounds to appear extremely improbable.

It must, however, be remembered that Herschel in the section we have just quoted is speaking of a dry atmosphere only, and that elsewhere he leads us to suppose that the effect of heat on an atmosphere of vapour would be ten times as great as upon one of dry air, and dynamical effects may thus become probable. We must consider, too, that the centre of gravity of the vapour portion of our atmosphere is very much lower than that of the dry portion, and would relatively be raised very much higher by a daily range of 20° of temperature. We have also to take into account the daily addition and subtraction which belongs to the vapour atmosphere through surface evaporation, surface condensation, and surface absorption. These causes, combined with one which has yet to be considered, may be fairly taken as sufficient to explain the whole of the normal daily inequality.

Herschel also says (Sec. 52) that vapour as soon as generated "tends to rise in the air by its buoyancy, and, in so doing, carries up with it much of the air with which it is intermixed, disengaging itself no doubt from it in its upward progress, to become entangled, however, with fresh particles, which again it carries upward, to abandon them for others, In this way, not only is its upward diffusion far more rapid than its horizontal, but in its struggle upward it tends to produce an ascensional movement in the air itself."

We thus see the intimate dependence of a full explanation of the daily inequality of the barometer on a knowledge of the distribution and fluctuations of the humid component of our atmosphere, and are again reminded of how much has yet to be learned on this part of our subject.

It should also be remembered that while the diminution of weight in the elevated aerial column in this latitude, which is due to difference in centrifugal force, is less than one-fourth of that due to loss of gravity itself, the diminution from centrifugal force is much greater in lower latitudes, as it varies with the square of the cosine of the latitude, and that at Bombay, for example, it is equal to three-fourths of that occasioned by decrease in the weight of the column from the greater distance from the earth of its centre of gravity.

The inspection of the Barometer curves for January and February, Figs. 1 and 2, Plate VIII., will probably have raised another difficulty, which was in a manner shirked by commencing our comparison at page 22 at sunrise instead of with the morning minimum. At sunrise the barometer is seen to be already rising rapidly, and the presence of the sun can, therefore, only add somewhat to a cause which is already in full operation. The barometer before sunrise is rising at the rate of more than 60 units per hour, and it does not much increase upon this rate afterwards. In fact, the pressure increases in January and February faster before sunrise than it does in July and August afterwards, when, as has already been seen, vapour is being added to the atmosphere in very much greater quantity. It seems plain, then, that an important element in the production of the barometric inequality has yet to be sought, and we are compelled to adopt one which has, thus far, been only slightly alluded to, though it has probably been insisted upon by most writers on this subject. We are thus brought to vapour tension in the lower layers of the air as the cause of a rise in the barometer through the inertia of the superincumbent atmosphere. This must be considered quite independently of the weight of vapour actually added to or taken from the atmosphere, as it may evidently be produced by the heat given out in the condensation of vapour already in the air, in the formation of low lying mists and fogs, as well as by the freezing of the minute particles of water suspended in the air at higher elevations.

It has been supposed that the explanation which serves for the midday fall of the barometer should also explain the night depression, and it has been urged, as an argument against the dynamical theory that it is not applicable to both of the daily depressions. It must at once be admitted that while we apply a mainly dynamical theory in one case, we trust to a mainly statical one in the other; in fact, we would suggest that the two depressions may be conveniently distinguished by these terms. The gradual abstraction of the moisture which has been added to the air during the day, and the consequent decrease in the weight of the atmospheric column as this moisture is precipitated upon and is absorbed by the now colder ground, is believed to be a sufficient explanation of the second depression. But this cause of the night depression is tempered and at last checked by the latent heat which is given out in the process, and, as we have already seen, this heat, long before sunrise, seems ultimately sufficient to commence and maintain with some vigour the morning rise of the barometer. The interesting experiments by Dr. Hamberg and his young friends at Upsala in the summer of 1875 on the temperature and humidity of the air at different heights from the ground strikingly support this view. Those who remember or will consult his curves of vapour pressure for nights with dew will recognise similar curves for the statical minimum in a later part of this paper.

The evening rise and night fall of the barometer exhibit in winter some peculiarities in the form of the curves, which resemble those we have already noticed in the summer curves of vapour pressure when contrasted with those for winter. These seem to separate the winter dynamical maximum into two parts, that which represents the sudden fall of the elevated and cooled air, when the upward current fails, and that caused by the more gradual settling down of the atmosphere, and which is due to the gradual and more general loss of its heat as night advances. Some other winter peculiarities in the night portion of the curves seem to be connected with changes in temperature from the formation of cloud, both as regards heat derived from change of form from vapour to water, and that due to the shelter from radiation which is thus afforded.

Having now taken a survey of the three principal components of the daily barometric inequality, traced some of their functions in producing daily and seasonal changes, and glanced at some of the principal causes which conspire to produce them, we are prepared to study the total inequality as exhibited in the curves for the different months; and by grouping together these curves for places in north latitude having considerable climatic differences, we are enabled to appreciate their common relationships, as well as their special contrasts. Tables 7 to 11 give the calculated daily inequalities for each month of the year, and at foot the co-efficients from which they were composed, while Plates IX. to XII. exhibit the curves themselves for Toronto, Greenwich, Oxford, and Upsala. Their general resemblance indicates the operation of similar causes, their differences suggest lines for inquiry.

It will become evident by inspecting these four plates that whatever may be the value of annual means, they cancel out many of the interesting features which are seen in the monthly curves.

TABLE 7.

TORONTO.—Daily Barometric Inequality. Calculated Values from Means of Six Years' Hourly Observations.

1843 to 1848 inclusive. Unit—·0001 of an inch.

Hour.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Means
Midnt.	— 10	— 80	14	— 94	— 15	— 72	— 6	— 51	— 73	11	— 30	— 58	— 39
1	11	—122	— 20	—182	— 52	—113	— 27	— 86	— 95	6	— 3	— 63	— 62
2	58	—112	— 59	—216	— 64	—119	— 39	—110	—109	2	39	— 31	— 63
3	57	— 88	— 82	—228	— 53	— 86	— 43	—131	—106	5	52	— 16	— 60
4	5	— 81	— 72	—183	— 4	— 16	— 30	— 91	— 54	9	26	— 50	— 45
5	— 57	— 62	— 24	— 58	83	84	49	1	48	13	— 2	— 67	1
6	— 35	8	49	120	173	169	147	110	154	43	33	5	81
7	47	116	132	274	239	256	221	203	236	113	112	135	176
8	153	225	206	356	270	284	250	253	288	195	184	244	242
9	239	304	248	388	277	290	251	290	310	241	228	294	280
10	240	326	235	348	248	263	232	282	289	226	219	275	265
11	115	248	171	276	168	193	174	238	219	152	145	165	189
Noon	— 82	82	70	134	87	102	116	167	127	33	8	— 16	69
1	—221	— 84	— 45	76	— 8	23	42	80	25	— 94	—117	—161	— 40
2	—248	—178	—153	— 16	— 94	— 43	— 40	— 16	— 87	—184	—163	—197	—118
3	—207	—202	—218	—110	—183	—120	—133	—127	—178	—213	—154	—174	—168
4	—131	—189	—224	—178	—250	—194	—216	—195	—242	—195	—126	—126	—189
5	— 77	—144	—180	—184	—271	—234	—249	—215	—230	—161	— 98	— 89	—178
6	— 1	— 63	—121	—140	—249	—235	—231	—198	—196	—119	— 59	— 27	—137
7	39	6	— 56	— 92	—195	—206	—185	—161	—134	— 69	— 36	21	— 89
8	41	37	2	— 72	—120	—146	—132	—123	— 84	— 25	— 56	12	— 56
9	39	42	40	— 60	— 36	— 68	— 69	— 62	— 50	— 1	— 78	— 18	— 27
10	36	28	49	— 60	22	— 23	— 18	— 32	— 25	4	— 75	— 31	— 10
11	15	— 14	37	— 84	18	— 19	0	— 28	— 45	8	— 49	— 44	— 17

Toronto.	Components from which the above values of the Daily Barometric Inequality were obtained.									
	Semicircular.		Quadrantal.		Sextantal.		Octantal.		Dodecantal.	
	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.
January	+ 29	+ 74	— 5	—118	+ 7	+91	—32	—17	— 9	—11
February	— 67	+ 85	+16	—170	—14	+48	—14	—16	— 1	—11
March	— 27	+103	+39	—144	— 1	+18	+ 3	+ 1	0	+ 3
April	—175	+121	+21	—169	+21	— 9	+ 5	+18	— 6	— 5
May	— 58	+184	+40	—120	+ 7	—27	— 1	— 3	— 7	— 1
June	—100	+175	+26	—110	+13	—37	— 4	— 9	— 7	— 3
July	— 78	+164	+50	— 98	+10	—25	+ 3	+ 7	— 5	— 4
August	—118	+139	+54	—120	+ 9	—15	+ 7	+ 6	— 3	+ 1
September	— 97	+161	+27	—138	— 3	— 8	+ 6	+ 6	— 6	+ 3
October	— 10	+122	+25	—111	— 1	+41	— 8	— 8	+ 5	+ 1
November	— 27	+113	0	— 88	+ 8	+67	—12	— 6	+ 1	— 5
December	— 40	+ 89	—14	—131	+19	+73	—24	— 6	+ 1	—17
Means	—64	+128	+23	—126	+6	+18	—6	—2	—3	—4

TABLE 8.

REENWICH.—Daily Barometric Inequality. Calculated Values from Means of 20 years' ho observations.

1854 to 1873 inclusive. Unit—·0001 of an inch.

Hour.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mea
Midnt.	25	51	81	58	100	80	79	74	53	89	53	20	6
1	− 32	20	56	35	74	42	42	40	23	58	21	− 4	3
2	− 37	− 12	14	0	35	0	1	2	− 19	19	− 9	9	
3	− 44	− 44	− 37	− 37	1	− 30	− 25	− 33	− 69	− 28	− 40	11	− 3
4	− 79	− 73	− 74	− 55	− 7	− 36	− 30	− 54	−108	− 72	− 70	− 19	− 5
5	−124	− 86	− 78	− 47	4	− 21	− 21	− 49	−112	− 93	− 89	− 62	− 6
6	−137	− 72	− 51	− 16	22	10	2	− 16	− 75	− 73	− 80	− 66	− 4
7	− 87	− 32	− 4	31	48	46	37	35	− 6	− 17	− 39	− 31	−
8	− 31	21	46	87	75	82	74	84	64	46	26	34	5
9	46	82	89	122	85	102	91	111	109	92	88	111	9
10	107	128	107	124	71	96	85	108	117	107	119	162	11
11	104	128	98	96	37	66	64	78	94	73	95	135	8
Noon	27	74	62	57	8	30	37	40	57	9	25	30	3
1	− 70	− 10	6	9	− 32	− 6	4	0	13	− 70	− 53	− 72	− 2
2	− 85	− 82	− 62	− 48	− 71	− 46	− 35	− 42	− 35	−125	−103	−111	− 7
3	− 54	−121	−123	−107	−117	− 86	− 73	− 87	− 83	−148	−110	−103	−10
4	− 15	−121	−150	−145	−149	−126	−108	−130	−114	−138	− 82	− 81	−11
5	17	− 84	−132	−152	−160	−151	−137	−151	−112	− 99	− 43	− 56	−10
6	53	− 30	− 85	−128	−146	−148	−142	−138	− 75	− 37	− 2	− 26	− 7
7	89	18	− 26	− 75	−100	−109	−107	− 87	− 14	25	27	− 5	− 3
8	85	45	26	− 7	− 27	− 36	− 40	− 16	46	72	50	4	1
9	84	60	63	50	47	42	31	49	83	96	66	21	5
10	87	70	84	76	89	94	77	88	89	107	77	46	8
11	74	70	88	72	106	102	94	94	75	106	73	47	8

Greenwich.	Components from which the above values of the Daily Barometri Inequality were obtained.									
	Semicircular.		Quadrantal.		Sextantal.		Octantal.		Dodecantal.	
	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.
January	+ 8	−52	+32	−67	− 9	+43	− 8	−24	+ 2	−10
February	+ 4	+ 7	+57	−80	−16	+28	− 6	− 4	0	− 3
March	+15	+28	+71	−77	− 6	+11	+ 2	+ 8	− 1	+ 1
April	0	+53	+66	−76	+ 1	− 3	− 7	+ 5	− 1	+ 3
May	+37	+70	+58	−58	+ 9	−14	− 4	+ 1	0	+ 4
June	+12	+60	+63	−63	+13	−19	− 7	− 4	− 1	+ 2
July	+ 8	+55	+62	−53	+13	−17	− 6	− 4	+ 2	+ 2
August	+ 7	+51	+67	−70	+10	−10	−10	+ 2	+ 1	− 1
September	− 3	+ 7	+65	−85	+ 1	+ 7	−10	+10	0	+ 1
October	+42	+12	+51	−93	− 2	+30	− 3	+ 1	+ 1	− 2
November	+15	− 3	+40	−77	− 1	+36	− 1	−12	0	− 1
December	+ 1	+26	+38	−65	− 7	+46	−10	−24	− 2	− 9
Means	+12	+26	+56	−72	+1	+12	−5	−3	0	−1

TABLE 9.

OXFORD.—Daily Barometric Inequality. Calculated Values from means for 16 years.*
1858 to 1873 inclusive. Unit—·0001 of an inch.

Hour.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
Midnt.	19	67	72	77	102	60	68	83	44	68	38	31	61
1	— 18	32	37	41	61	27	28	38	— 4	19	7	15	24
2	— 46	— 9	— 9	— 4	19	7	— 3	— 4	— 54	— 33	— 27	18	— 12
3	— 82	— 50	— 51	— 48	— 9	— 11	— 21	— 42	— 90	— 73	— 63	— 1	— 45
4	— 127	— 89	— 74	— 60	— 6	— 15	— 21	— 54	—104	— 98	— 86	— 43	— 65
5	—163	— 97	— 69	— 39	18	15	2	— 37	— 87	—107	— 95	— 73	— 53
6	—168	— 60	— 36	21	55	70	43	7	— 46	— 83	— 73	— 66	— 28
7	—131	11	9	79	92	117	82	55	17	— 27	— 21	— 23	23
8	— 65	79	58	116	112	139	99	84	67	30	50	47	68
9	12	126	93	126	105	141	97	92	91	61	103	127	98
10	66	135	107	103	73	114	79	78	93	63	109	150	98
11	72	90	93	71	29	51	48	46	80	43	61	99	65
Noon.	35	— 5	42	18	— 16	— 20	6	7	50	0	— 12	— 18	7
1	— 10	—104	— 37	— 35	— 65	— 69	— 36	— 40	— 4	— 61	— 81	—111	— 54
2	— 28	—159	—121	—100	—119	—101	— 75	— 90	— 68	—103	—119	—140	—102
3	— 16	—158	—173	—158	—165	—141	—117	— 140	—112	—113	—113	—125	—128
4	13	—119	—172	—188	—190	—179	—152	— 174	—126	— 94	— 72	— 91	—129
5	51	— 55	—123	—179	—186	—185	—162	—165	—101	— 53	— 19	— 43	—102
6	90	10	— 44	—115	—149	—150	—133	—113	— 44	7	27	— 2	— 51
7	115	57	31	— 41	— 80	— 91	— 74	— 33	31	75	59	19	6
8	119	69	80	34	4	— 21	— 5	48	87	122	84	31	54
9	110	70	99	80	77	51	57	106	107	133	93	55	87
10	92	77	99	101	115	96	95	130	97	121	85	75	98
11	60	82	91	103	123	95	96	120	76	101	65	51	89

Oxford.	Components from which the above values of the Daily Barometric Inequality were obtained.									
	Semicircular.		Quadrantal.		Sextantal.		Octantal.		Dodecantal.	
	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.
January	+ 2	—93	+34	— 58	—10	+36	— 6	— 9	—1	—3
February	+27	+11	+27	—106	+ 9	+46	+ 3	— 3	+1	—5
March	+30	+22	+48	—104	—15	+19	+ 8	+ 7	+1	0
April	+26	+62	+48	—102	+ 3	— 6	0	+13	—1	+1
May	+52	+84	+44	— 87	+ 7	—18	— 2	+ 4	+1	+2
June	+27	+94	+36	— 89	+13	—16	—10	+ 1	— 6	—3
July	+25	+68	+42	— 75	+ 6	—20	— 4	+ 2	—1	—2
August	+39	+45	+50	— 96	— 1	—15	— 4	+ 8	—1	—1
September	+ 5	+ 1	+43	—100	— 8	+ 2	+ 1	+10	+3	0
October	+37	— 28	+31	— 96	— 3	+17	— 2	+ 3	+5	—1
November...............	+20	—14	+18	— 91	+ 5	+36	— 5	— 7	0	+2
December...............	+21	+19	+27	— 82	+ 3	+51	—14	—21	—7	—5
Means	+26	+23	+37	— 91	+ 1	+11	— 3	+ 1	—1	—1

* Hourly values were obtained by drawing a fair curve through the two-hourly observations plotted on a moderately large scale. The components for the calculated values were thus deduced from twenty-four instead of twelve daily terms.

TABLE 10.

OXFORD.—Vapour Pressure Daily Inequality. Calculated Values from Means for 16 years.*

1858 to 1873 inclusive. Unit—·0001 of an inch.

Hour.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
Midnt	— 18	— 36	— 64	—114	—107	—131	— 49	- 69	— 82	— 86	— 67	—34	— 7
1	— 14	— 36	— 69	—140	—140	—181	—105	— 91	—125	—107	— 79	—34	— 9
2	— 10	— 41	— 94	—162	—185	—235	—157	—126	—158	—123	— 79	—33	—11
3	— 20	— 68	—111	—183	—217	—266	—190	—184	—190	—132	— 75	—37	—13
4	— 42	— 81	—133	—202	—232	—276	—206	—235	—217	—141	— 79	—46	—15
5	— 58	— 89	—138	—215	—238	—250	—207	—238	—240	—151	— 94	—48	—16
6	— 67	— 77	—131	—197	—215	—185	—170	—183	—245	—158	—107	—51	—14
7	— 72	— 64	—114	—139	—132	— 92	— 93	— 98	—206	—147	—106	—58	—11
8	— 70	— 54	— 83	— 52	— 16	10	— 20	31	—123	—103	— 86	—54	— 5
9	— 50	— 40	— 27	27	70	92	8	56	— 34	— 26	— 49	—43	—
10	— 12	— 7	36	78	109	135	13	90	56	59	9	— 9	4
11	30	36	83	112	132	141	33	91	119	129	28	28	8
Noon.	68	80	106	140	155	131	67	77	162	166	119	60	11
1	102	118	121	166	160	133	91	77	177	181	149	84	14
2	116	133	134	188	153	149	109	90	180	183	163	91	14
3	100	118	135	197	154	166	120	100	186	178	155	77	14
4	64	82	129	188	160	174	118	101	195	165	124	56	13
5	30	70	120	152	142	166	101	132	188	137	80	42	11
6	9	33	101	111	111	145	100	151	163	90	43	33	9
7	— 8	18	64	77	96	116	127	140	130	37	16	20	6
8	— 20	— 2	19	54	88	84	144	101	93	— 9	— 2	6	4
9	— 22	— 20	— 11	19	48	48	114	52	44	— 32	— 19	— 5	1
10	— 18	— 29	— 24	— 28	— 21	— 1	55	6	— 10	— 47	— 33	—13	— 1
11	— 18	— 34	— 41	— 78	— 76	— 63	— 3	— 37	— 59	— 63	— 51	—26	— 4

Oxford Vapours.	Components from which the above values of the Daily Vapo Inequality were obtained.									
	Semicircular.		Quadrantal.		Sextantal.		Octantal.		Dodecanta	
	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.	Cos.	Sin
January	— 38	— 45	+30	+36	— 5	— 7	— 2	+ 4	—3	—
February	— 57	— 62	+24	+27	— 1	— 7	0	+10	—2	—
March	— 83	—105	+22	+13	— 2	+11	+ 3	— 5	—4	—
April	—132	—143	+26	— 6	+ 5	+11	—15	— 1	+2	+
May	—135	—143	+30	—38	+ 4	+20	—14	+ 3	+8	+
June	—150	—151	+11	—60	+19	+14	—10	—14	+1	—
July	— 65	—141	+13	—47	+ 7	— 6	—13	—14	+9	+
August	— 87	—133	+14	—50	+14	+34	— 6	—11	—4	—
September	—117	—181	+35	— 2	—10	+23	— 3	— 5	+3	+
October	—119	—116	+38	+26	— 7	+ 8	+ 3	—13	—1	
November	— 82	— 83	+28	+35	—11	— 8	— 3	— 3	+1	—
December	— 37	— 48	+14	+21	—10	— 6	+ 2	+ 3	—3	—
Means	— 92	—113	+24	— 4	0	+ 7	— 5	— 1	0	

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* Hourly values were obtained by drawing a fair curve through the two-hourly observations pl on a moderately large scale. The components for the calculated values were thus deduced from tw four instead of twelve daily terms.

TABLE 11.

UPSALA —Daily Barometric Inequality. Calculated values from the Means for six years' hourly observations, 1868 to 1874 inclusive.

Unit—·0001 of an inch.

Hour.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Means.
Midnt.	16	64	35	36	48	47	31	49	44	7	28	36	37
1	4	51	34	26	29	32	24	24	15	— 8	16	28	23
2	4	27	28	17	13	10	20	2	—11	— 38	5	30	9
3	— 10	— 4	13	— 2	— 3	— 12	15	—16	—40	— 71	— 7	22	— 10
4	— 41	—37	— 7	— 17	— 7	— 17	19	—24	—60	—103	—25	— 3	— 27
5	— 80	—63	— 16	— 15	2	— 5	37	—20	—61	—115	—47	—41	— 35
6	—106	—82	0	9	21	14	56	— 7	—50	—106	—59	—69	— 32
7	—106	—71	38	39	40	35	73	10	—29	— 67	—43	—77	— 13
8	— 65	—45	69	62	57	59	89	30	8	— 11	— 1	—45	17
9	0	— 4	85	70	65	71	101	49	47	43	45	12	49
10	56	40	90	65	55	70	96	58	71	78	71	68	68
11	66	67	80	48	31	52	68	50	61	90	64	72	62
Noon.	36	58	49	24	4	35	35	31	34	75	26	32	37
1	4	19	— 2	— 6	— 19	19	8	4	1	42	—20	—18	2
2	— 2	—22	— 56	— 42	— 43	— 12	— 22	—22	—33	4	—49	—42	— 28
3	10	—42	— 99	— 84	— 73	— 50	— 61	—51	—64	— 21	—53	—44	— 53
4	27	—45	- 129	—116	— 99	— 81	-101	—72	—76	— 19	—39	—33	— 65
5	36	—31	—128	—121	—108	—103	—133	—84	—67	3	—25	—21	— 65
6	34	—12	— 92	— 89	— 97	—108	—146	—77	—40	28	—11	— 9	— 51
7	22	5	— 42	— 39	— 62	— 91	—133	—54	— 7	49	3	— 9	— 30
8	11	15	— 5	6	— 15	— 49	— 91	—18	32	53	17	— 3	— 4
9	20	22	9	36	35	2	— 31	22	68	45	31	18	23
10	34	38	18	47	63	36	14	54	85	28	37	44	42
11	30	59	38	44	63	48	32	62	71	16	39	50	46

Upsala.	Components from which the above values of the Daily Barometric Inequality were obtained.									
	Semicircular.		Quadrantal.		Sextantal.		Octantal.		Dodecantal.	
	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.
January	— 5	—42	+34	— 7	— 5	+28	—5	—19	—3	—2
February	+13	—15	+52	—18	—10	+20	+7	— 3	+2	—2
March	+ 3	+56	+42	—48	—10	+10	—2	+ 9	+2	—3
April	+11	+45	+36	—49	— 5	— 4	—5	+ 9	—1	—1
May	+18	+47	+34	—43	+ 4	—11	—6	0	—2	+1
June	— 3	+50	+45	—31	+ 8	—11	—3	0	—1	+3
July	—11	+87	+42	—28	+ 9	—14	—6	— 5	—3	+1
August	+ 6	+28	+42	—35	+ 3	— 7	—1	— 3	—1	0
September	+10	— 2	+45	—54	— 5	+ 3	—3	— 3	—3	+1
October	—26	—43	+39	—44	— 8	+24	+1	+ 4	+1	+1
November	+ 6	— 1	+30	—34	— 5	+23	—4	—10	+1	0
December	+14	— 4	+40	—16	—11	+26	—2	—20	—3	+3
Means	+ 3	+17	+40	—34	— 3	+ 7	— 2	— 3	—1	0

We now proceed to show how these curves of monthly means for long periods also conceal various and, perhaps, unsuspected fluctuations which single months exhibit in different years, nay, which are seen even in the course of a few days in the same month under the influence of change and range of temperature, of cloud and sunshine.

In fact, we must be prepared to look on the daily inequality as a phenomenon which is constantly changing from day to day, in the same manner that we see the temperature curves and zigzags change as we turn over leaf by leaf of the Quarterly Weather Reports, and compare the changes at the same station during different weeks with each other, and with those for the same periods at the other observatories. No better illustrations can be given than by comparing the sometimes very irregular temperature curves with the fair looking curves which are obtained from the means of monthly or longer periods. It is by taking these barometric curves for short and well marked periods in respect to the special meteorological conditions on which they may be supposed to depend, that we may expect ultimately to identify the variations due to each, to trace them to their causes, and to give to them the numerical value which science requires.

In all the following illustrations the observations are taken from selected days, *i.e.* for days on which the total range of the barometer has been small, and in each case the very necessary correction for obliquity has been made. Fig. 1, Plate XIII., gives the curve for 23 selected days from the month of January, 1870, at Upsala; and in this case the parts due to the different components are shown, as it affords a very typical case, in which they all conspire to produce a marked result. Fig. 2, Plate XIII., gives similar curves for 23 selected days in January, 1869, 27 days in January, 1871, and 23 days in January, 1872. Table No. 12 gives the barometric co-efficients for the same months and the mean for six years at Upsala, and other features which distinguish January in these years.

Observing that cloud seemed to indicate special contrasts in the barometric curves, a selection of days was made with this in view for January, April, July, and October, and the inequality curves for these are delineated in Figs. 3 and 4, Plate XIII., and Figs 1 and 2, Plate XIV. It was found that absence of cloud was so rare at Upsala in October that it was with difficulty that so many as 30 days were selected when cloud was 5 or less, total cloud being indicated by 10.

As the available records of the British observatories give no information respecting the daily amount of cloud, it was thought that range of temperature was the next best, if not a precisely similar guide to differences in the barometric inequality, and in order to test this a selection has been made from the published observations of the barometer at Kew. Fig. 3, Plate XIV., and Fig. 1, Plate XV., will illustrate this, and Table No. 13 will give the numerical details. One point which deserves notice in the selected days for Kew is, that the mean temperature is nearly the same for the both sets of selected days in Fig, 3, Plate XIV., though the range of temperature in one is twice as much as in the other. The absence in the published records for the seven British observatories of mean values and columns showing range and maxima and minima, are a great discouragement to the meteorologist who desires to take a rapid survey of the chief causes of the differences now under discussion.

The publication of sunshine records will probably give a stimulus to this inquiry. Since most of these pages were written, the appearance of the paper by Mr. Ellis* on this subject has suggested what may be taken as a crucial test of the effect of sunshine on the daily barometric inequality. Mr. Ellis directs attention to eight days in August, 1876, which are remarkable for continuous sunshine, and these days have been selected for comparison with eight other days in the same month when there was little or no sunshine. As barometer observations for these days at Greenwich were not available, recourse has been had to the published records for Kew, as it was thought there was not likely to be much difference between either the barometer or the sunshine records of places so near each other. The result is shown in Fig. 2, Plate XV., and numerically in Table No. 18, and will probably be accepted as decisive. The analysis shows that in this instance the chief change is in the semicircular component, the change in it being proportionately about twenty times greater than in the quadrantal component. The vapour pressure curves for these two sets of days also illustrate in a remarkable manner some of our previous remarks. During the days of much sunshine the vapour curve, instead of being merely truncated, as appears usual in the summer months, shows a very deep depression; a most decided proof, if any additional evidence were required, that when there is a very rapid upward movement of the air, the dry and wet bulb thermometers cease to indicate more than the momentary hygrometric condition of the stratum of air in which they are placed.

A similar trial of barometric observations made during days or months in which the sunshine was chiefly in the morning, as compared with those made on days or months in which the sunshine was chiefly in the afternoon, would probably exhibit a considerable change in the quadrantal angle, which as a rule we have found changes very slightly with change of season.

The action of sunshine on the sides of hills in accelerating the upward movement of the air, and of radiation from hill sides and hill tops in accelerating the downward fall of the air, has been alluded to in a previous paper on the Mount Washington observations. The following incidental remark by Piazzi Smyth, in the account of his Teneriffe Expedition, is worthy of note in this connection, and perhaps may serve to explain some of the anomalies to which he refers in respect to the want of accordance in the heights of the mountain as deduced from observations taken at different hours of the day. At Alta Vista, he says, "generally by day, in normal weather, there was an east wind blowing up from the plain, and by night a west wind blowing down from the Peak." May not some of the instances of great daily inequality in the barometer which have been noticed in India be connected with local winds "blowing up" the heated valleys, and "blowing down" from the sides of snow-clad mountains during "normal weather"?

There is no novelty in saying that the situation of an observatory must be known in order to understand the details of its meteorology. Some of the occasional and apparently inexplicable differences between the daily readings of the barometer at adjacent places may perhaps be due to changes of wind which place one station on the lee side, and the other on the windward side of the hill.

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* Quarterly Journal of the Met. Soc., Vol. III., page 460.

To briefly summarise, there can be little doubt that each of the four following causes contributes to produce the daily inequality of the barometer, neither of them taken alone being apparently adequate to produce the observed result:—

1. Addition to barometric pressure by vapour tension, owing to the inertia of the superincumbent mass of the atmosphere.

2. Change of pressure due to the weight of vapour daily added to and withdrawn from the atmosphere.

3. A difference in barometric pressure arising from the raising and lowering of the centre of gravity of the column of air above and near the instrument.

4. The dynamical effect upon the barometer of ascending and descending currents of air.

These separate constituents all alike depend on change of temperature, and their action is thus primarily traced to the sun. Unfortunately, we can at present do little more than speculate as to what fraction of the daily inequality is due to each, and as to the time of the day or night when the influence of each is greatest. They all appear to mix and graduate into each other in such a way as to make analysis appear almost hopeless.

Vapour tension, as distinct from the weight of the added moisture, may be supposed to have its maximum effect in the early morning, and to decrease towards the middle of the day, when the general upward movement of the lower atmosphere begins to make itself felt, and a decided fall of the barometer becomes evident. Air tension from the same cause must be supposed to be included in the term vapour tension. Possibly the curious fluctuations in the inequality curve for the barometer which occur between sunset and midnight, especially in January, February, and March, may also be traced to this cause (see Plate IX.), and may indicate change of tension in moderately elevated air strata during formation and absorption of cloud, and in the general settling down or shrinking of the atmosphere at night.

The weight of vapour daily added to the air by surface evaporation,* and again taken from it by surface absorption or by deposition as dew or rain, is at present another unknown quantity. It may be supposed to vary pretty much with the temperature curve, and to have its *plus* maximum from one to three hours later than the surface temperature maximum, according to the season of the year. The diagrams constructed from the usual data for vapour pressure significantly show a truncated appearance at times when the vapour added to the air is certainly increasing (see Fig. 3, Plate IV.; also Fig. 3, Plate VIII.). A remarkable example of the inadequacy of the present mode of ascertaining vapour pressure† is also given in Plate XV., Fig. 2, for Kew.

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* The printed observations of the Madrid Meteorological Observatory have for many years given the weight of water evaporated at the level of the ground each twenty-four hours from an iron vase, exposing a circular surface of water 30 centimetres in diameter.

† Note, p. 22.

Here the diagram shows a rapid decrease in vapour pressure from 8 a.m. to about 4 p.m., during which time there can scarcely be a doubt the moisture in the air was constantly increasing in quantity. Some suggestions for obtaining additional meteorological data from moderately elevated stations have already been made by the writer at page 231, Vol. II., of the Quarterly Journal of this Society.

That portion of the inequality which is due to the raising and lowering of the centre of gravity of the atmospheric column, and the times of its maximum and minimum, will probably be elucidated by the discussion of the observations now being made at mountain stations in the United States of North America, France, and elsewhere.

The dynamical part of the barometric inequality is the fourth unknown quantity to which reference has been made. To it is probably due a considerable part of the mid-day fall and evening rise of the barometer. Its principal maximum and minimum are undoubtedly very near together in winter and more widely separated in summer.

To discuss probable values for these elements of the barometric inequality for the different seasons of the year would too much extend this very long paper, but the writer hopes to be allowed to attempt this in a future essay on the daily rotation of the wind.

Absolute temperature is undoubtedly an important element in producing the barometric inequality, but we have seen that range of daily temperature is perhaps of equal influence. The great dependence of range of temperature on the hygrometric condition of the air shows this to be a third element, scarcely less important than the other two. While we may fairly conclude that free radiation of heat at night, and free absorption of heat by day, are the conditions most favourable to the development of the daily barometric inequality, we are compelled to say that the proximate causes are still to be counted as unknown quantities. Until the four principal elements to which we have referred have been each numerically valued, and have been together found insufficient, we may reasonably refuse to consider the possible influence of electricity, or of magnetism, or of some other unknown element whose existence seems at present to be purely hypothetical?

From what has already been said, it will also be inferred that the temperatures which are of most value to a discussion of this kind are not those obtained by protected thermometers, but by those which are freely exposed to sunshine and radiation.

If the illustrations which have now been given of the variations which constantly occur in the daily barometric inequality and their connexion with change and range of temperature, with cloud and sunshine, &c., are as new to the Fellows of the Society as they are to the writer, this part of my communication will not be without interest; but it has been felt that the labour involved in a thorough investigation of this subject is too great for any one to undertake who has not a large staff of computers and much leisure at his command. The co-operation of other meteorologists is, therefore, invited in the further development of the subject. By division of labour, and a free discussion of our Observatory records, much might be done in a

TABLE 12.

UPSALA.—Daily Barometric Inequality under different conditions of Cloud and Sunshine, &c.

Unit—·0001 of an inch.

Hour.	January, 1869. 23 days.	Components for January, 1870. 23 days.					Jan. 1871. 27 days.	January, 1872. 23 days.	January, 1870.		January, 1870 Vapour.		April.		July.*		October.	
		Polar.	Quadrantal.	Sextantal.	Octantal and Dodecantal	Do. Sum.			11 days. warm, wet, cloudy.	12 days. colder, dryer, less cloud.	11 days. warm, wet, cloudy	12 days. colder, dryer, less cloud	39 days. cloud 0 or less than 5.	55 days. cloud 6 and above.	22 days. cloud 3 or less.	14 days. cloud 9·5.	30 days. cloud 5 or less.	30 days. cloud 10.
Midnt.	— 60	— 73	39	—13	— 5	— 52	37	17	— 50	— 48	—22	—59	— 11	66	27	126	— 34	25
1	— 59	— 95	34	16	—17	— 62	16	15	— 65	— 59	—23	—49	0	35	36	72	— 43	10
2	— 54	—109	21	36	—12	— 63	6	11	— 64	— 73	—20	—37	9	— 2	49	25	— 44	— 17
3	— 54	—117	1	34	6	— 76	— 2	— 6	— 72	— 87	—14	—22	5	— 46	75	— 3	— 53	— 54
4	— 65	—117	—19	13	18	—105	—23	— 28	—109	—104	— 7	— 5	8	— 82	109	— 22	— 71	— 97
5	— 86	—108	—34	—16	11	—147	—67	— 52	—169	—130	0	7	39	— 98	137	— 46	— 83	—114
6	—115	— 92	—39	—36	— 7	—174	—99	— 84	—205	—148	1	16	88	— 93	152	— 66	— 68	—115
7	—117	— 70	—34	—34	—17	—155	—91	—100	—183	—128	0	21	139	— 74	161	— 74	— 19	— 76
8	— 70	— 43	—21	—13	—10	— 87	—46	— 66	—115	— 56	3	25	174	— 62	165	— 70	47	— 23
9	24	— 13	— 1	16	6	8	4	6	— 40	47	6	26	185	— 30	153	— 65	105	26
10	105	17	19	36	16	89	39	61	22	135	18	27	167	— 22	119	— 57	140	59
11	132	48	34	34	11	127	42	63	53	177	31	29	122	— 25	72	— 48	137	68
Noon.	108	73	39	13	— 5	120	12	31	60	166	42	33	67	— 24	23	— 46	98	51
1	71	95	34	—16	—17	96	—22	1	63	121	47	37	10	— 19	— 24	— 50	43	24
2	46	109	21	—36	—12	82	—31	— 15	82	77	38	39	— 57	— 14	— 71	— 45	— 6	7
3	48	117	1	—34	6	90	—14	— 12	120	63	24	40	—129	— 18	—115	— 29	— 39	4
4	67	117	—19	—13	18	103	4	16	143	72	5	35	—184	— 18	—159	— 18	— 55	7
5	88	108	—34	16	11	101	5	40	139	72	—12	25	—197	— 2	—201	— 20	— 52	16
6	71	92	—39	36	— 7	82	6	36	127	46	—21	10	—168	27	—226	— 18	— 28	31
7	29	70	—34	34	—17	57	17	8	114	6	—24	— 9	—121	62	—213	8	15	42
8	— 10	43	—21	13	—10	25	38	— 6	97	— 24	—21	—27	— 74	96	—159	54	19	41
9	— 22	13	— 1	—16	6	2	54	12	60	— 39	—16	—44	— 37	118	— 89	101	19	34
10	— 31	— 17	19	—36	16	— 18	61	27	14	— 43	—18	—57	— 19	118	— 29	141	2	31
11	— 46	— 48	34	—34	11	— 37	54	25	— 23	— 41	—19	—61	— 16	97	8	150	— 17	30

* These were the only days in Six Years with so much cloud, otherwise a greater number of days would have been selected.

TABLE 12—*Continued.*

Upsala.	Components of the Daily Barometric and Vapour Inequalities.									
	Semicircular.		Quadrantal.		Sextantal.		Octantal.		Dodecantal.	
	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.
January, 1869. 23 days	−68	− 56	+27	0	−16	+37	+ 1	−23	− 4	+ 2
" 1870. 23 days	−73	− 92	+39	+ 1	−13	+36	− 6	−16	+ 1	0
" 1871. 27 days	+17	− 32	+33	−20	− 5	+20	−12	−16	+ 4	0
" 1872. 23 days	− 2	− 30	+30	− 5	− 5	+30	0	−22	− 6	+ 4
" 11 warm wet and cloudy days, 1870	−44	−134	+18	+ 5	−11	+32	−17	−10	+ 4	+ 2
" 12 days colder, drier and less cloud, 1870	−95	− 60	+54	− 6	−12	+37	+ 4	−20	+ 1	+ 2
" Vapour pressure first 11 days	−27	+ 3	+10	+ 5	− 5	− 8	..	..	..	..
" Vapour pressure for the 12 days	−46	+ 3	−13	+ 9	− 7	−11	..	..	..	..
April. 39 days cloud 0, or less than 5	−35	+127	+37	−68	− 4	− 1	− 6	+12	− 3	0
" 55 days, cloud 6 and above	+44	− 61	+29	−37	+ 1	− 1	− 6	+ 5	− 2	+ 1
July. 22 days, cloud 3 or less	− 8	+170	+30	−24	+10	−19	− 6	− 8	+ 1	+ 2
" 14 days; 7 days cloud 10, 7 days cloud 9*	+77	− 37	+37	−18	+ 9	−13	− 1	−12	+ 4	− 1
October. 30 days, cloud 5, or less	−51	+ 3	+39	−56	−15	+23	− 8	0	+ 1	− 2
" 30 days, cloud 10	−15	− 48	+39	−30	+ 2	+25	− 2	+ 1	+ 1	− 2

* These were the only days in Six Years with so much cloud, otherwise a greater number of days would have been selected.

TABLE 13.

KEW.—Barometer and Vapour Pressure. Calculated Daily Inequalities.

Unit—·0001 of an inch.

ur.	1877. Jan. 7 days. Temp. range. 6°.	1877. Jan. 7 days. Temp. range. 13°.	1877. Jan. 7 days. Vapour.	1877. Jan. 7 days. Vapour.	January.		January. Vapour Pressure.		August, 1877. Barometer.		August, 1877. Vapour Pressure.	
					33 days. Temp. range 6°	27 days. Temp. range 12°	27 days. Temp. range 6°	27 days. Temp. range 12°	8 days. Mean Sunsh. 2 hours.	8 days. Mean Sunsh. 11·5 hours.	8 days. Mean Sunsh. 2 hours.	8 days. Mean Sunsh. 11·5 hours.
	1	2	3	4	5	6	7	8	9	10	11	12
nt.	— 72	— 8	— 25	—134	45	22	—43	— 77	13	54	—179	162
	— 91	13	—15	—171	24	11	—43	— 93	— 38	51	—101	159
	— 92	60	—14	—205	17	11	—39	—127	— 71	37	— 52	97
	— 91	64	—10	—220	3	— 2	—29	—150	— 92	17	— 82	— 25
	—107	14	5	—196	— 37	— 29	—16	—146	—104	29	—156	—105
	—109	— 42	14	—158	— 81	— 51	— 7	—132	— 85	85	—173	—109
	— 81	— 63	— 2	—138	— 88	— 52	—17	—122	— 22	150	—103	— 25
	— 21	— 46	—32	—118	— 35	— 19	—33	—112	43	199	— 19	107
	61	4	—45	— 74	43	48	—38	— 90	74	227	28	207
	145	80	—24	— 18	111	126	—15	— 66	92	233	39	199
	192	134	12	19	141	175	21	— 25	123	199	68	93
	183	103	49	59	112	143	51	43	142	127	121	— 21
m	126	4	75	128	29	48	71	135	115	44	177	— 86
	59	— 91	77	205	— 68	— 57	79	196	54	— 39	223	—125
	10	—140	58	253	—119	—127	73	215	— 9	—133	226	—175
	— 21	—152	34	264	—121	—162	61	208	— 68	—231	158	—229
	— 35	—134	27	252	—101	—135	46	190	—120	—293	70	—251
	— 31	— 74	28	204	— 71	— 87	31	156	—127	—293	47	—221
	— 13	11	8	120	— 34	— 34	9	104	— 74	—248	89	—137
	5	64	—26	44	15	1	—19	52	— 7	—183	105	— 13
	13	72	—51	10	43	22	—36	6	26	—103	28	97
	13	64	—56	— 2	55	44	—37	— 32	36	— 19	— 98	143
	— 2	46	—48	— 35	61	53	—34	— 63	49	39	—192	136
	— 35	15	—39	— 89	56	43	—35	— 75	50	53	—219	135

KEW—Components from which the above were constructed.

	B. Barometer. V. Vapour Pressure.	Semicircular.		Quadrantal.		Sextantal.		Octantal.		Dodecantal.	
		Cos.	Sin.	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.	Cos.	Sin.
B	Temperature range 6°	— 86	— 7	+39	— 71	—13	+27	—10	— 8	—2	— 2
B	Do. 13°	+ 32	+ 23	+20	— 66	—38	+60	—14	— 8	—8	— 8
V	Do. 6°	— 38	— 5	+13	+ 30	—12	0	+14	— 7	—2	+ 4
V	Do. 13°	—148	—153	+ 5	+ 26	+17	—24	— 6	— 8	—2	+10
B	Do. 6°	+ 16	+ 18	+43	— 76	— 8	+45	—12	—12	+3	— 5
B	Do. 12°	+ 5	+ 37	+43	— 83	—18	+46	— 4	—16	—4	— 2
V	Do. 6°	— 48	— 18	+11	+ 22	—13	— 5	+ 5	— 8	—2	+ 1
V	Do. 12°	—110	—126	+16	+ 44	+ 4	—13	+10	+ 7	+3	+ 5
B	Sunshine 2 hours per day	— 39	+ 19	+58	— 83	—12	— 7	+ 8	+10	+1	—11
B	Sunshine 11·5 hours per day ..	+ 2	+188	+56	—104	+ 3	—11	0	+ 8	—7	+ 3
V	Sunshine 2 hours per day	—155	— 67	+ 9	+ 23	—23	+29	— 4	+62	—6	—11
V	Sunshine 11·5 hours per day	+ 88	+ 74	+55	—141	+35	+18	—22	+50	+4	+ 8

few months towards obtaining not only a qualitative but a quantitive investigation of this portion of British Meteorology.* May not the Meteorological Council of this country be fairly expected to assist in this work, and at least to equal, if not to rival, the University of Upsala in the neatness and completeness of its published data, and be induced to give such further details for all of our observatories as the advances in meteorological science show to be necessary? If this has been made clear, one of my objects in submitting this paper to your notice will have been attained.

DISCUSSION.

Mr. Ellis said that Mr. Rundell had discussed the barometric inequality for the few places treated in a manner more complete than had ever been before done. The grouping of the observations for short periods seems important, as bringing out in a remarkable manner the effect of cloud and sunshine on the magnitude of the diurnal inequality, as exhibited that evening. Usually, the grouping of such observations has been by months or years only. Mr. Abercromby, in a recent paper, also advocated the more independent consideration of the diurnal variation. Mr. Rundell's analysis of the observed barometric curves brings to light phenomena which could not otherwise be perceived. He has included in his paper tables giving the values of the co-efficients of the separate portions of the whole inequality for each month of the year, which allow us to trace their variations through the year, and also their epochs of maxima and minima, in a way which is highly interesting. The whole paper seems deserving of careful study.

Mr. Budd believed that the clouding was a function of the time of day and season of the year, differing for each station, and therefore its effect on the diurnal inequality should be easily detected.

Mr. Strachan said that the subject was a very obscure one, and as a theory of curves was quite mystical to most meteorologists, simply because there existed no good explication of it. Mr. Rundell had presented a most elaborate paper, which was in itself of sufficient size to make a separate book; but notwithstanding, he believed that the subject admitted of much greater simplicity and clearer explanation. If he (Mr. Strachan) had had the subject to deal with, he would have treated it in quite a different manner; but he was bound to say that he doubted if he would have been able to make it more intelligible. What was wanted was, to have a radically clear explanation of the plan involved. He could not imagine that so great a difference could occur between two places so near together as Greenwich and Oxford, which were only 60 miles apart in a level country; for even in India at much greater distances, and at various elevations above the sea, such differences were not so noteable. This he believed was due, to the kind of instruments used, and also to the manner of tabulating the observations. The cloud anomalies referred to by Mr. Rundell might be due to the non-periodic variations of pressure. Constants grow in value with the number of observations used, and he was sure that the results derived from the observations of one month or one year were very doubtful, as it was too short a period to base any trustworthy conclusion upon. He would like to know how one could reduce the constants for a place at some height above the sea to what they would have been at the sea level.

Mr. Ellis, referring to the suggestion of the last speaker that the different construction of the registering apparatus at Greenwich and Oxford may be a cause of difference in the results, stated that Mr. Rundell's paper, as he understood it, indicated, in the main, a very satisfactory agreement between Greenwich and Oxford.

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* Mr. Chambers has boldly attacked some of the problems connected with this subject in the recently issued volume on the Meteorology of the Bombay Presidency, and leads one to anticipate that he will yet have the honour of fully developing the relations which exist between the various meteorological elements. It is, however, to be regretted, where he has done so much and so well, that he did not add to the comparison of the different diurnal variations illustrated by his Tables 87 and 88, similar details for vapour pressure. The materials for it are given in his Table 38.

Mr. SYMONS suggested that trial of the influence of cloud might be obtained in Spain, where the amount of cloud differed greatly at stations close together in the same latitude. Although an extremely large amount of attention had been given to this subject, as stated by the author, there would be found in M. Peltier's paper more than 200 authors cited, yet it was remarkable how slightly all writers noticed what others had done before them; for instance, the present paper did not refer to Mr. Chambers's investigations, and last week, at the meeting of the Société Météorologique de France, the paper upon this subject was virtually merely an attempted demolition of M. Renou's paper upon the same subject. There seemed to him to be an absence of thoroughness in noticing what had been done before. The difference between Oxford and Greenwich might be accounted for by the one having a more seaside position than the other. Much information on diurnal range might be gathered from Major Williamson's work, which he might bring to the recollection of those concerned.

Mr. FIELD could not agree with Mr. Strachan, that it was useless to take short periods, but thought that Mr. Rundell had attacked the subject in the right way. By taking short periods it was possible to investigate the effects of particular conditions of cloud, sunshine, &c., in a way that could never be effected by merely dealing with averages. Of course it would never do to draw general conclusions from a single short period, but if several short periods were selected when the same conditions prevailed, and they all led to the same result, then general conclusions might fairly be drawn.

Captain TOYNBEE suggested that the difference of diurnal range on cloudy days, as compared with that on clear days, might probably result from the fact that cloudy days are generally those on which cyclonic systems are sweeping over these islands, which are accompanied by such great oscillations of pressure that the effect of diurnal range is nearly masked, whilst on clear days the pressure is probably steady, when the chief oscillation is that of diurnal range.

Mr. J. ALLAN BROUN said the subject of the diurnal variations of the barometer had occupied him at various times during nearly forty years. His remarks on Mr. Rundell's paper may be arranged as follows:—

Mode of Investigation.—Mr. Rundell has sought to represent the variations by the superposition of curves of sines whose period is a day, or an aliquot part of one. The use of this method has lately been criticised by Dr. Wild, of St. Petersburg.[*] Dr. Wild's views were long held by Mr. Broun, who derived them from his Professor and friend, the late Principal J. D. Forbes. Dr. Wild shows that the maxima and minima, as well as their epochs, may be determined with as much accuracy, and much more easily from the observations when carefully projected in curves. In cases, however, where the numbers of observations are not sufficiently numerous to eliminate variations which are independent of the length of the day, Mr. Broun believes the harmonic analysis (as Sir W. Thomson has well termed this method) is much more satisfactory. There are also other objects which may be attained by the use of the method of sines, which render its employment of great importance. Without entering into the subject generally, Mr. Broun wished to point out that wherever different causes of variation may exist in the same place at different times, or in different places at the same time, if these affect differently the single, double or triple oscillations in the 24 hours, it may be possible by this separation of the oscillations to trace their immediate or secondary causes. He cited cases of such applications. He had found from observations accurately corrected for temperature, that the annual law of the earth's horizontal magnetic force consisted in a maximum near each solstice, and a minimum near each equinox. Now having to consider observations which had not been, and could not be, accurately corrected for temperature, it was evident that the error due to that cause would be found chiefly in the term for the single oscillation [$a_1 \sin(\theta + c_1)$], while the second term, or that representing the double oscillation [$a_2 \sin (\theta + c_2)$], would be little affected by the annual change of temperature. The second term would thus show whether the earth's magnetic force obeyed the law derived from other observations. This was found to be the case both for the amplitude and epochs. (Edinburgh Transactions, Vol. XXII., p. 531, 1861.) Dr. von Lamont has employed similar considerations with reference to the diurnal variation of the barometer. He has concluded that a part of the diurnal oscillations is due to the variations of temperature, and part to an electrical action of the sun ; the first term of the function of sines containing the temperature result, and the second being due chiefly to the electrical action. Knowing the expressions which represent the thermometric and barometric variations at any station, the amount of the tidal ("Ebbe und Fluth") term, supposed the only result of the electrical action, is easily determined. Mr. Broun thinks the method may have many useful applications in this way, but he does not agree with Dr. von Lamont in attributing the first term of the barometric expression to varying temperature alone ; a result which could be true according to the hypothesis, which had been suggested also by Mr. Broun, only in case the electrical action were exactly equal on opposite meridians at the same time. An electrical action of the sun upon our atmosphere would probably be different with the *dryness* of the air, and it may be from other conditions, such as temperature. Mr. Rundell alludes to the error introduced in the calculated terms through the last observation of the diurnal series not agreeing with the first. This source of error should be got rid of as much as possible by a correction, on the assumption that the change during 24 hours is a regular one, the most probable hypothesis that can be proposed. Such a correction Mr. Broun believes was first applied by himself in the Makerstoun Observations for 1844 (p. 422). He remarked also the necessity of applying a correction for the equation of time when accurate results for the epochs are sought for the different months of the year. Such corrections had been applied by him in his discussions of the Makerstoun Observations.

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[*] Die Temperatur-Verhältnisse des russischen Reiches. Repertorium für Meteorologie. Supplement, Band 1877. Dr. Wild has pointed out that the method of sines usually attributed to Bessel is really due to Lambert, to whom J. D. Forbes also assigned it in his paper on the Temperature of the Earth, 1846. Edinburgh Transactions, Vol. XVI,, p. 214.

Results.—Mr. Rundell refers to the movement of the tropical or turning hours with the season of the year. This was remarked early in this century by Ramond and others, and the relation of these variations to sunrise and sunset has been pointed out for each epoch in the discussions of the Makerstoun observations. One of the most remarkable results of these discussions was, that if the curves representing the diurnal variations in summer and winter were placed below each other, so that the observed height for midnight of one was on the same ordinate as that for noon of the other, the two curves would be found to resemble each other in a marked manner ; the night oscillation for winter being slightly greater than the day oscillation in summer.* This result agrees with Quetelet's conclusions from the Brussels observations (Climat de la Belgique, 4 me. ptie. p. 9) ; and may be deduced from the equations of sines given by Dr. Lloyd in the Dublin observations ; if in that for the winter months $x + 180°$ be written for x, the equation for the summer months will be obtained very nearly (Vol. I. p. 395). Dr. Lloyd has also pointed out the larger oscillation in winter than in summer as opposed to the law of range of temperature, and the explanation of the former by the latter. Mr. Broun believes it is very useless to insist on the variations of temperature as the cause of the semi-diurnal variation of the barometer, and to omit to notice facts like these, which are wholly inexplicable by such a cause. Mr. Rundell has also referred to considerable differences in variations at places so near each other as Greenwich and Oxford : such differences have been pointed out lately by Mr. Buchan. Observations made in India have long shown that the afternoon depression appears greatest at the months of highest temperature, not merely those when the diurnal variation of temperature is greatest ; this difference Mr. Broun has associated with the increased dryness of the atmosphere. The remarkable differences found by Mr. Buchan demand especially the attention of Meteorologists at the different stations where they are shown, for the purpose of investigating the local causes to which they may be due. Mr. Rundell has made several special investigations of great interest ; among others one on the effect of cloud and sunshine on the diurnal variation of the barometer. This subject was studied in a general way by the late Dr. Buist, who compared the variations at Bombay during the monsoon and the fine season. Mr. Broun had made an investigation by the method of sines for the same season at Trevandrum. Dr. von Lamont, however, has made a discussion for Munich both for clear and cloudy months, and for clear and cloudy days: his conclusions are therefore more definite. He finds that the difference of the expressions is chiefly or altogether in the term for the single or diurnal oscillation, that representing the semi-diurnal oscillation remaining unchanged. There appears, therefore, an apparent relation to the range of the temperature variation in the amplitude of the single oscillation; but Mr. Broun remarked that this relation, which is shown in the equations for the different seasons of the year in our latitudes, is not to be detected in the *arguments* (c_1) of the first terms for those seasons; the turning points by the latter changing 12 hours from spring to summer, while the corresponding change for the temperature variation is not 1 hour. Similar conclusions had been arrived at from observations made simultaneously at different heights on the South Indian Ghats, where Mr. Broun found the turning points by the first term to change 7 hours in ascending 6,000 feet, while those by the second or tidal term agreed within a few minutes. Among the interesting conclusions derived from the series of observations referred to were the following:—the observed night oscillation, that from 9 p.m. to 9 a.m., had nearly the same amplitude at all heights from the sea level to 6,000 feet above it. When the method of sines is employed, it is found that the amplitude of the second, the semi-diurnal, oscillation diminishes in ascending as the pressure diminishes: or if r be the range of the oscillation at any height for which the total pressure is p,

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* Results of Makerstoun Observations, Trans. Royal Society, Edinburgh, Vol. XIX, p. xcv.

$$\frac{r}{p} = \text{constant.}$$

This constant is nearly the ratio of the centrifugal force to the force of gravity, and very nearly that of the compression of the earth. Laplace finds that the proportionality of the amplitude of the oscillation to the pressure should hold for the oscillations of the atmosphere produced by the attraction of gravitation of the sun or moon. The result found by Mr. Broun cannot be explained by the attraction of gravitation, otherwise the lunar would be greater than the solar oscillation, but may be due to another attractive force acting according to the same law, though in a different manner.

Hypotheses.—Mr. Broun had referred to different hypotheses in his preceding remarks. The thermic theory had been presented in various manners, the ascensional current and vapour pressure theory had disappeared. He had shown that at a station near the sea-shore in South India, the vapour pressure might vary on the average of a series of observations nearly one-tenth of an inch of mercury less from *morning* to *evening* than at a station ten miles distant and four miles from the sea, while the variation of barometric pressure shown by the barometers at the stations was exactly the same. Dr. von Lamont had shown the same result by a laboratory experiment. Mr. Broun believed that the ascension current hypothesis, whether of air or of vapour, required only to be compared with the facts of the diurnal oscillations within the tropics and in high latitudes to be found wholly impossible, while any serious effort to calculate the effects of such currents would suffice to show their total insignificance compared with the variation to be explained. He concluded, from his consideration of the facts noticed by him and of many others on which he could not touch, that they required a cause such as had been suggested by Dr. von Lamont and himself; but he believed that more facts were required before any hypothesis will be generally accepted as true and sufficient.

Mr. Rundell's paper seemed to be an energetic effort to grapple with various important questions. Mr. Broun's remarks, founded on the subjects touched on in the abstract communicated to the meeting, gave only his own previous conclusions. Any critical consideration of Mr. Rundell's investigations could be possible only after they were published.

Mr. RUNDELL briefly replied to the remarks of the different speakers, and complimented the Society and himself on the presence of so distinguished a meteorologist as Mr. Broun, and the prominent part which he had taken in the discussion.

Report on the Phenological Observations for the year 1878. By the Rev. T. A. Preston, M.A., F.M.S. (Plate XVI.)

[Read November 20th, 1878.]

Thirteen of last year's Observers have sent in returns for 1878, only four having failed to so. On the other hand, we have returns from Harpenden, Redbourne Bury, Uppingham, Hatton, Fennes, Odsey and Chester.

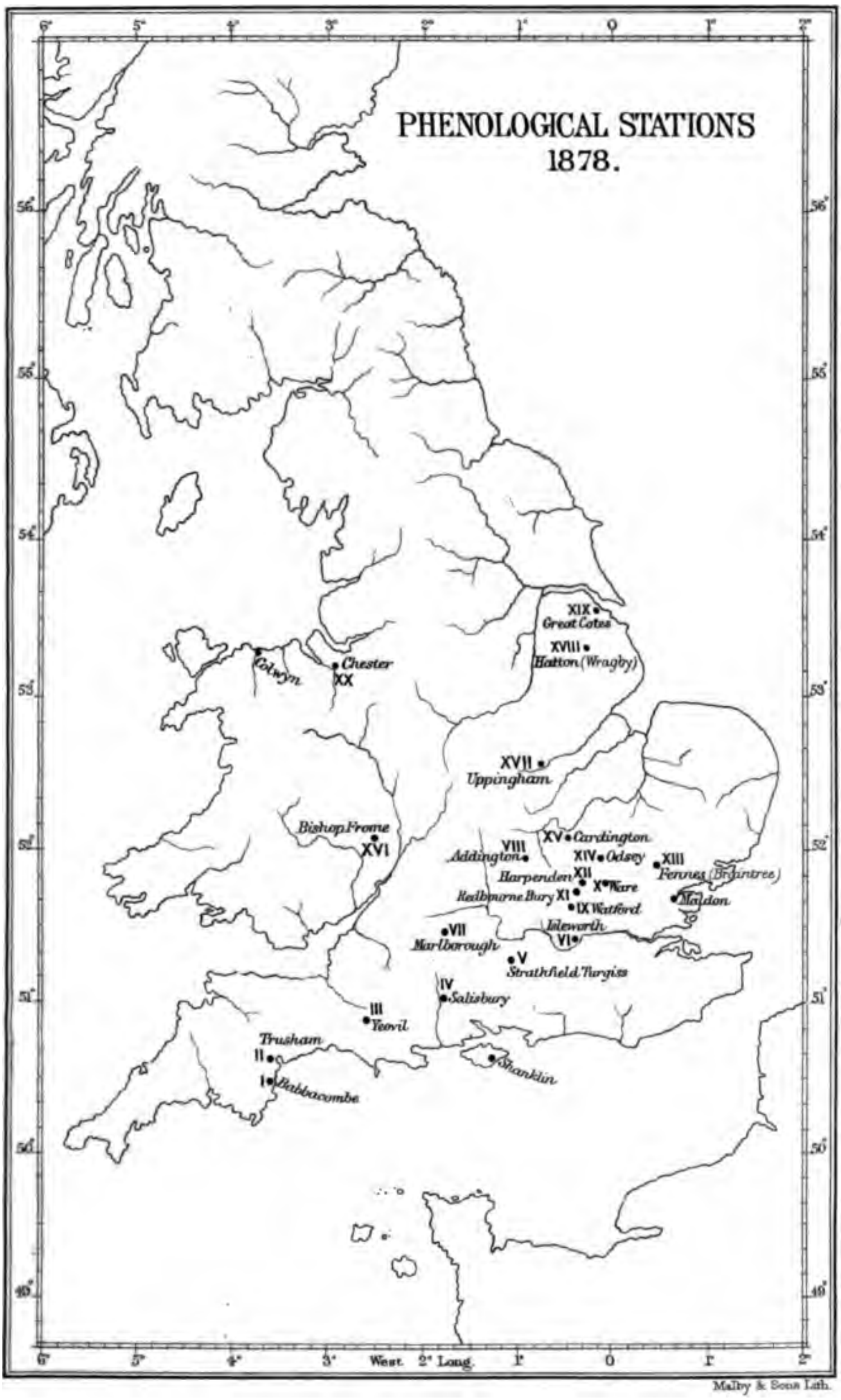
I.	Babbacombe, Devon.	E. E. Glyde, F.M.S.
II.	Trusham, Devon.	Rev. W. Moyle Rogers.
III.	Yeovil, Somerset.	Rev. J. Sowerby.
IV.	Salisbury, Wilts.	W. Hussey.
V.	Strathfield Turgiss, Hants.	Rev. C. H. Griffiths, F.M.S.
VI.	Isleworth, Middlesex.	Miss E. A. Ormerod, F.M.S.
VII.	Marlborough, Wilts.	Rev. T. A. Preston, M.A., F.M.S.
VIII.	Addington, Bucks.	John Matthison.
IX.	Watford, Herts.	John Hopkinson, F.L.S., F.M.S.
X.	Ware, Herts.	Lieut. R. B. Croft, R.N., F.L.S.
XI.	Redbourne Bury, Herts.	Mrs. Arnold.
XII.	Harpenden, Herts.	J. J. Willis.
XIII.	Fennes, Essex.	H. S. Tabor, F.M.S.
XIV.	Odsey, Cambridge.	H. G. Fordham, F.L.S.
XV.	Cardington, Bedford.	J. McLaren, F.M.S.
XVI.	Bishop Frome, Hereford.	Rev. H. L. Graham.
XVII.	Uppingham, Rutland.	W. H. Jones.
XVIII.	Hatton, Lincolnshire.	Mrs. Charles Jarvis.
XIX.	Great Cotes, Lincolnshire.	J. Cordeaux.
XX.	Chester, Cheshire.	A. O. Walker, F.L.S., F.M.S.

The returns have been more than usually complete, and in order to get all the notices into one Table, the day of the year has been substituted for the month and day of month. The usual (?) has also been omitted, as full particulars are given in the "notes." Several observers have kindly sent specimens, though a good many are still wanting.

A discussion arose as to whether it would be better to have a few special plants under cultivation, and take dates of flowering from them, or to take the wild plants, as is now done. The matter was referred to those who were considered best able to judge, and so unanimous were they as to the desirability of continuing the present plan, that I trust the matter has been finally set at rest.

It may be worth while noticing that of the stations at which observations have been taken this year, Yeovil, Bishop Frome, and Chester, are in a line due S to N; Trusham, Yeovil, Salisbury, Strathfield Turgiss, Isleworth, and Fennes, lie in a line from SW to NE; and Isleworth, Watford, Cardington, Uppingham, Hatton, and Great Cotes, in a fairly direct line from S to N.

The Rev. C. H. Griffith has kindly undertaken the Entomological part of the Report, and Mr. J. Cordeaux the Ornithological, and their discussions of the Returns is given herewith.



Malby & Sons Lith.

Taken as a whole, the last quarter of 1877 was mild, though November was a dull month with some severe gales. This did not, however, affect vegetation to the same extent as is usually the case, for a most extraordinary number of flowers, both cultivated and wild, were in bloom almost all the winter. Not only were many plants able to survive the few frosts, but some species were very early in their time of flowering. Thus both the Holly and the Ivy were found in flower near Birmingham early in January; whilst the *Primrose*, which, indeed, may often be found in flower at Christmas was not only unusually plentiful then, but was in flower in several woods all the winter, and in many other places during the latter part of January: it was in flower at Bishop Frome and Marlborough in October, at Strathfield Turgiss on December 7, and at Trusham on December 27. *White Violets* were found at Bishop Frome on October 18, and at Strathfield Turgiss on December 28. *Snowdrops*, at Great Cotes, in sheltered places, were ready to burst into flower on December 1 (though they were apparently in the same state on January 31). The *Lesser Celandine* was in flower at Trusham on December 17 and 22, where also 29 species were found in flower during the last week of December, and 4 more on January 2, many of which lasted long into January. Perhaps a more distinct idea of the state of flowers during these months may be gathered from the following table of plants in flower :—

	OCTOBER.			NOVEMBER.			DECEMBER.	
	1875.	1876.	1877.	1875.	1876.	1877.	1876.	1877.
Trusham......	...	...	...	...	...	90	...	83
Marlborough	173	184	272	69	214	165	...	104
Isleworth ...	...	186	194	...	84	108	81	57

About the middle of October occurrred almost the most severe frost of the year. The Ivy was just then in flower, and consequently very few perfected their seeds, and Ivy berries were very scarce at Christmas. The Hazel, too, at this time began to form its catkins, and the frost probably affected their subsequent expansion, for not only was the flowering much later than usual, but the flowers they bore were by no means so vigorous as they ought to have been.

In addition to the full description of defoliation given in the last Report, the following notes may be added:—

ELM. About 10 days earlier than last year, at Salisbury.

OAK. Generally bare on November 14, at Bishop Frome. In 1876 they were in full leaf, and a few only changing in colour on November 15. Leafless, December 8, at Babbacombe.

LIME. Not quite bare on October 22, at Salisbury.

At Salisbury the autumnal tints were richest about November 7.

At Bishop Frome trees were generally leafless about November 8.

And at Strathfield Turgiss on November 1.

At Babbacombe a hurricane on October 14 had a terribly scorching effect on the evergreen shrubs, many of which seemed completely killed.

TABLE I.

No.	Plant.	I. Babbacombe.	II. Trusham.	III. Yeovil.	IV. Salisbury.	V. Strathfield Turgiss.	VI. Isleworth.	VII. Marlborough.	VIII. Addington.	IX. Watford.	X. Ware.	XI. Redbourne Bury.	XII. Harpenden.	XIII. Fennes.	XIV. Odsey.	XV. Cardington.	XVI. Bishop Frome.	XVII. Uppingham.	XVIII. Hatton.	XIX. Great Cotes.	XX. Chester.
1	ANEMONE NEMOROSA	..	n	63	60	70	77	61	94	..	67	67	n	..	..	72	61	68	n	n	73
2	RANUNCULUS FICARIA	71	n	15	21	50	49	18	..	59	52	59	n	..	..	42	32	n	..	n	48
3	*Ranunculus acris*	125	119	109	105	108	112	79	..	..	..	..	107	120	..	47	118	..	107	121	
4	CALTHA PALUSTRIS	..	n	47	n	70	66	50	n	..	80	72	97	..	..	60	71	n	..	55	73
5	*Papaver Rhœas*	168	147	134	156	172	146	157	..	146	151	167	..	..	146	155	..	160	..	161	..
6	*Cardamine hirsuta*	67	2	47	40	..	96	34	..	..	..	..	..	..	..	62	..	n	..	..	..
7	*Cardamine pratensis*	115	106	77	67	86	96	76	108	97	98	..	97	106	..	96	102	101	112	89	..
8	*Draba verna*	..	n	n	24	..	61	48	..	..	..	..	..	..		48	..	48	..	..	n
9	*Viola odorata*	71	53	51	61	56	70	61	59	63	..	66	13	..	62	57	28	n	..	n	..
10	*Polygala vulgaris*	115	121	127	110	..	..	116		..	..	..	150	..	130	144	152	137	..	181	125
11	*Lychnis Flos-cuculi*	..	143	137	134	134	137	134	139	148	..	..	149	..	..	139	145	130	164	143	171
12	*Stellaria Holostea*	94	69	82	85	102	94	95	..	83	100	87	86	106	..	105	105	n	107	105	95
13	MALVA SYLVESTRIS	161	159	157	156	175	153	161	.	150	154	154	..	177	164	163	..	159	169	161	
14	*Hypericum tetrapterum*	..	194	..	..	183	191	181	..	..		..	191	177	..	193	..	..	184	193	..
15	*Hypericum pulchrum*	189	175	..	..	..	n	182	..	178	..	..	176	175	..	..	..	..	..	201	..
16	GERANIUM ROBERTIANUM	67	61	112	112	111	132	123	141	118	121	..	125	121	..	126	127	129	..	124	118
17	TRIFOLIUM REPENS	155	137	120	143	126	134	134	153	129	144	..	126	139	132	138	..	..	142	161	..
18	*Lotus corniculatus*	135	143	134	134	..	139	132	n	135	151	154	..	132	..	138	..	130	146	141	..
19	*Vicia Cracca*	189	174	..	..	..	172	179	..	..	..	..	176	..	..	152	..	181	178	165	..
20	*Vicia sepium*	125	103	112	117	112	115	116	..	114	120	..	112	116	..	132	117	125	..	..	..
21	*Lathyrus pratensis*	171	148	156	155	..	160	157	..	150	..	158	159	164	..	161	..	160	171	161	..
22	PRUNUS SPINOSA	87	64	72	70	77	90	72	97	..	75	70	58	104	71	76	95	93	102	90	..
23	*Spiræa Ulmaria*	..	169	159	161	170	172	168	170	173	..	169	168	171	..	169	165	180	..	172	..
24	*Potentilla anserina*	142	141	116	127	..	137	129	171	138	136	..	138	142	131	134	..	145	180	138	..
25	*Potentilla Fragariastrum*	71	10	n	n	45	80	21		65	74	63	68	..	..	54	51	62	..	76	..
26	*Rosa canina*	157	145	154	154	133	151	151	155	146	150	139	149	148	147	158	150	156	161	154	n
27	*Epilobium hirsutum*	..	199	..	..	..	185	190	..	..	..	..	..	182	..	189	194	..	191	189	..
28	*Epilobium montanum*	..	162	159	..	176	166	161	..	..	..	..	158	..	..	161	..	..	..	..	174
29	*Angelica sylvestris*	..	195	..	..	..	201	210	..	..	..	..	..	216	..	198	..	..	..	..	..
30	*Anthriscus sylvestris*	..	..	n	63	..	109	n	117	97	..	96	74	..	..	60	104	..	..	115	..
31	HEDERA HELIX	260	..	..	246	..	245	264	..	250	..	..	..	270	..	238	..	..	..	..	..
32	*Galium Aparine*	135	124	123	142	128	132	124	142	132	137	..	137	..	131	126	..	125	161	162	..
33	*Galium verum*	175	177	..	..	..	191	179	174	180	..	..	180	..	178	173	188	179	180	185	..
34	*Dipsacus sylvestris*	..	..	..	..	..	n	210	..	..	..	..	..	214	..	197	..	..	215	..	..
35	*Scabiosa succisa*	224	194	..	..	179	229	218	..	228	..	..	..	..	..	n	234	..	180	217	..
36	*Petasites vulgaris*	..	..	23	63	81	n	38	..	..	61	..	..	..	..	..	..	n	..	78	73

TABLE I.—*Continued.*

No.	Plant.	I. Babbacombe.	II. Trusham.	III. Yeovil.	IV. Salisbury.	V. Strathfield Turgiss.	VI. Isleworth.	VII. Marlborough.	VIII. Addington.	IX. Watford.	X. Ware.	XI. Redbourne Bury.	XII. Harpenden.	XIII. Fennes.	XIV. Odsey.	XV. Cardington.	XVI. Bishop Frome.	XVII. Uppingham.	XVIII. Hatton.	XIX. Great Cotes.	XX. Chester.
37	TUSSILAGO FARFARA	..	n	49	61	65	55	48	59	..	52	71	n	..	48	47	48	69	..	49	50
38	ACHILLEA MILLEFOLIUM	185	166	..	..	..	172	173	..	173	..	..	168	..	..	171	181	181	164	200	..
39	*Chrysanthemum Leucanthemum*	127	120	109	124	121	127	136	141	135	140	154	137	147	..	121	n	154	148	162	..
40	*Artemisia vulgaris*............	..	203	..	..	..	186	213	..	220	..	..	..	..	..	..	..	..	..	218	..
41	*Senecio Jacobæa*	179	164	168	..	137	152	180	..	178	..	..	188	..	179	183	184	..	176	200	..
42	CENTAUREA NIGRA............	..	168	165	..	171	152	180	..	167	..	..	168	170	..	166	169	173	191	173	..
43	*Carduus lanceolatus*	..	184	..	..	..	183	194	.	..	..	..	167	214	..	195	..	..	..	191	..
44	*Carduus arvensis*	171	177	170	..	..	177	180	..	..	..	..	179	..	..	182	..	..	..	172	..
45	*Sonchus arvensis*	..	181	..	..	246	183	190	..	..	..	..	188	226	..	180	..	..	n	n	..
46	*Hieracium Pilosella*	157	143	123	124	..	134	132	172	141	..	..	131	165	..	130	..	..	142	..	..
47	CAMPANULA ROTUNDIFOLIA	..	..	..	..	187	206	194	..	..	..	..	187	202	..	..	195	179	193	199	..
48	*Gentiana campestris*	..	..	..	..	..	..	207	..	..	..	..	..	..	..	..	..	166	..	..	...
49	CONVOLVULUS SEPIUM	208	184	..	..	166	182	195	..	..	..	..	190	..	..	191	..	..	..	211	..
50	*Symphytum officinale*	..	..	117	112	122	n	116	..	..	..	..	..	..	..	..	..	132	..	..	..
51	*Pedicularis sylvatica*..........	..	117	98	n	121	n	112	137	..	..	..	..	..	..	..	110	..	122	..	..
52	*Veronica Chamædrys*	115	n	74	65	n	102	90	..	114	115	..	n	114	..	106	115	..	..	n	114
53	*Veronica hederifolia*..........	34	n	n	..	..	32	n	59	..	..	..	n	..	12	24	..	..	..	..	..
54	*Mentha aquatica*..............	..	209	..	..	197	n	211	..	..	..	..	..	214	..	207	..	..	219	215	..
55	*Thymus Serpyllum*	173	175	169	158	..	..	153	..	..	..	..	184	..	153	n	..	166	..	..	..
56	*Prunella vulgaris*	..	158	164	..	..	173	167	154	..	..	..	178	..	..	163	163	163	176	..	..
57	*Nepeta Glechoma*	73	64	73	63	..	88	66	..	81	78	..	74	..	95	76	78	82	..	68	n
58	*Galeopsis Tetrahit*	..	190	..	..	..	..	192	..	..	..	..	178	..	..	187	..	..	..	..	..
59	*Stachys sylvatica*	..	158	154	153	..	146	157	..	153	145	..	157	n	..	157	165	161	164	..	174
60	*Ajuga reptans*	127	n	108	110	..	122	117	119	118	120	..	124	122	..	121	n	130	120	136	..
61	PRIMULA VERIS	94	..	81	96	68	n	102	..	80	78	72	81	98	91	86	71	n	96	83	102
62	*Plantago lanceolata*	n	102	99	..	105	114	113	117	114	..	..	113	120	..	108	127	..	122	134	..
63	*Mercurialis perennis*	82	42	49	31	..	69	31	..	47	51	..	n	..	..	43	50	56	..	75	51
64	*Ulmus montana*	69	61	56	..	n	58	57	..	..	..	..	n	..	62	67	88	..	..	..	.
65	*Salix caprea*	57	..	63	59	n	..	67	..	63	63	63	n	..	65	62	61	..	..	70	n
66	*Corylus Avellana*	36	n	27	21	43	23	39	59	47	25	..	49	..	..	41	50	56	..	..	51
67	*Orchis maculata*.......... ...	177	..	142	137	..	..	150	..	150	..	..	..	..	..	153	130	150	145	159	171
68	*Iris Pseud-acorus*	169	148	..	138	152	152	141	155	145	145	139	168	..	..	153	..	166	162	153	..
69	*Narcissus Pseudo-narcissus*	..	n	64	..	60	60	48	n	68	60	..	n	..	61	72	68	..	..	..	..
70	*Galanthus nivalis*	28	24	26	17	32	44	20	n	..	23	..	24	..	29	20	n	..	..	31	26
71	*Endymion nutans*	95	n	101	99	98	104	102	..	112	112	105	108	..	..	n	109	105	119	114	104

TABLE II.

No. and Name.	Year.	Yeovil. III.	Strathfield Turgiss. V.	Isleworth. VI.	Marlborough. VII.	Cardington XII.	Great Cotes. XV.
70. *Galanthus nivalis* (Snowdrop)	1875	Jan. 26	Jan. 2 (?)	....	Jan. 15	....	....
	1876	Feb. 19 (?)	Jan. 31	Jan. 30 (?)	Jan. 30	Jan. 28 (?)	Feb. 1
	1877	Jan. 23	Jan. 18	Jan. 19	Jan. 21	Jan. 11	Jan. 20
	1878	Jan. 26 (?)	Feb. 1	Feb. 13	Jan. 29	Jan. 20	Jan. 31
66. *Corylus Avellana* (Hazel)	1875	Jan. 16	Jan. 5	....	Jan. 18	....	....
	1876	Jan. 28	Jan. 6	....	Jan. 23	Jan. 29	....
	1877	Jan. 9	Jan. 9	Jan. 28	Jan. 15 (?)	Jan. 15	....
	1878	Jan. 27	Feb. 12	Jan. 23	Feb. 8	Feb. 10	....
2. RANUNCULUS FICARIA (Pilewort)..	1875	Jan. 16	Feb. 9 (?)	April 5 (?)	Feb. 1	April 5	March 30
	1876	Feb. 19	Feb. 8	March 2	Feb. 15	Feb. 19	March 13
	1877	Jan. 9	....	Feb. 19	Jan. 19	Feb. 8	March 8
	1878	Jan. 15	Feb. 19	Feb. 18	Jan. 18	Feb. 11	Feb. 24
63. *Mercurialis perennis* (Dog's Mercury)	1875	Jan. 30	April 4	....	March 5	Mrch. 23 (?)	....
	1876	Feb. 22	March 14	....	Feb. 29	Feb. 24	April 7
	1877	Feb. 6	Feb. 9	....	Jan. 25	Feb. 5	....
	1878	Feb. 18	....	March 10	Jan. 31	Feb. 12	March 16
37. TUSSILAGO FARFARA (Coltsfoot) ..	1875	Mar. 13 (?)	....	April 9 (?)	March 10	Mrch. 23 (?)	March 15
	1876	Feb. 22	Feb. 21 (?)	March 14	Feb. 29	Feb. 26	March 13
	1877	Jan. 14	May 5	Feb. 21	Feb. 14	Feb. 11	Feb. 14
	1878	Feb. 18	March 6	Feb. 24	Feb. 17	Feb. 16	Feb. 18
25. *Potentilla Fragariastrum* (Barren Strawberry)	1875	....	Jan. 27 (?)	April 13 (?)	March 5	....	....
	1876	Feb. 5	Feb. 23	....	Feb. 28	March 9	....
	1877	All the Year	Jan. 19	March 22	Feb. 11	Feb. 19	April 8
	1878	All the Year	Feb. 14	March 21	Jan. 21	Feb. 23	March 17
9. *Viola odorata* (Sweet Violet) ..	1875	Jan. 28	Jan. 23	....	March 13	Mrch. 22 (?)	March 9
	1876	Feb. 8	Jan. 8	Feb. 5	March 2	March 2	March 4
	1877	Feb. 10	Jan. 4	Mar. 16 (?)	Feb. 25	Feb. 18	Feb. 17 (?)
	1878	Feb. 20	Feb. 25	Mar. 11 (?)	March 2	Feb. 26	March 2
65. *Salix caprea* (Great Sallow) ..	1875	March 10	March 6 (?)	....	March 14	April 1 (?)	Mar. 17 (?)
	1876	March 4	....	....	March 1	March 23	March 11
	1877	Feb. 16	....	....	Feb. 8	....	March 30
	1878	March 4	(March 6)	....	March 8 (?)	March 3	Mar. 11 (?)
69. *Narcissus Pseudo-narcissus* (Daffodil)	1875	April 3	March 18 (?)	....	March 23	Mrch. 23 (?)	....
	1876	March 10	March 7	March 14	Feb. 29	March 15	....
	1877	March 6	Feb. 24	March 6	Feb. 14	March 15	....
	1878	March 5	March 1	March 1	Feb. 17	March 13	....
64. *Ulmus montana* (Wych Elm)	1875	March 10	(March 11)	....	March 9	Mrch. 26 (?)	....
	1876	Feb. 28	....	Mar. 11 (?)	Feb. 28	March 7	....
	1877	Feb. 14 (?)	April 30	Feb. 23	Feb. 27	Feb. 25	....
	1878	Feb. 25	March 1	Feb. 27	Feb. 26	March 8	....
8. *Draba verna* (Whitlow Grass)	1875	....	....	April 2 (?)	March 26	April 5	....
	1876	....	....	March 8	Feb. 27	Feb. 22	....
	1877	All the Year	....	Feb. 8 (?)	Feb. 18	Jan. 27	....
	1878	All the Year	....	March 2	Feb. 17	Feb. 17	....
1. ANEMONE NEMOROSA (Wood Anemone)	1875	April 2	Mch. 21 (?)	....	March 17	April 4	April 4
	1876	March 17	March 24	Mar. 31 (?)	March 2	March 28	April 1
	1877	March 3	March 15	Mar. 26 (?)	March 14	March 27	April 1
	1878	March 4	March 11	March 18	March 2	March 13	March 16
4. CALTHA PALUSTRIS (Marsh Marigold)	1875	March 17	....	....	March 27	April 25	April 12
	1876	Feb. 9	March 14	March 30	Feb. 28	April 3	March 7
	1877	Feb. 9	Feb. 16	March 31	Feb. 14	Feb. 18	March 30
	1878	Feb. 16	March 11	March 7	Feb. 19	March 1	Feb. 24
57. *Nepeta Glechoma* (Ground Ivy) ...	1875	March 29	....	....	May 3	April 27	April 14
	1876	March 16	March 30	April 7	April 1	April 4	April 12
	1877	March 10	....	April 11	n	April 3	April 12
	1878	March 14	....	Mar. 29 (?)	March 7	March 17	March 9
22. PRUNUS SPINOSA (Blackthorn)	1875	March 31	Mch. 30 (?)	April 16	April 12	April 16	April 11 (?)
	1876	April 4	April 4	April 4	April 6	April 3	April 8
	1877	March 6	....	March 3	March 24	Feb. 17	April 2
	1878	March 13	March 18	March 31	March 13	March 17	March 31

TABLE II.—*Continued.*

d Name.	Year.	Yeovil. III.	Strathfield Turgiss. V.	Isleworth. VI.	Marlborough. VII.	Cardington XII.	Great Cotes. XV.
LA VERIS)	1875	April 2	April 1	April 23	April 19 (?)	April 10 (?)	April 12
	1876	March 25	April 3	April 24	April 16	April 6	April 5
	1877	March 31	....	April 17	April 7	April 4	March 28
	1878	March 22	March 9	....	April 12	March 27	March 24
eus sylves- w Chervil)	1875	Feb. 2	....	....	April 19	May 5	....
	1876	March 17	....	April 17	April 26	April 27	....
	1877	Feb. 9	April 24	April 9	April 1	April 14	....
	1878	March 15	....	April 19	n	March 1	April 25 (?)
nine pra- (Cuckoo-	1875	April 1	April 14 (?)	....	April 26	April 25	April 24
	1876	April 8	April 15	April 24	April 5	April 21	April 18
	1877	March 14	April 13	March 31	April 1	April 14	April 12
	1878	March 18	March 27	April 6	March 17	April 6	March 30
a Holostea Stitch-	1875	....	April 15 (?)	....	April 19 (?)	May 7	....
	1876	April 4	April 11	April 1 (?)	April 16	April 27	April 22
	1877	Feb. 14	March 20	March 27	March 26	April 23	April 8
	1878	March 23	April 12	April 4	April 5	April 15	April 15
nion nu- e-bell) ..	1875	April 23	April 24	....	April 8	....	April 24
	1876	April 28	April 20	April 20 (?)	April 16	April 25	April 22
	1877	April 9	April 18	April 17	April 10	April 23	May 3
	1878	April 11	April 8	April 14	April 12	....	April 24
ca Chamæ- ermander ll)	1875	March 30	April 17	April 25 (?)	April 19 (?)	May 9	....
	1876	April 3	....	April 16	May 3	May 2	....
	1877	March 17	March 19	April 21	April 24 (?)	May 1	....
	1878	March 15	Feb. 16	April 12	March 31	April 16	n
go lanceo- wort Plan-	1875	April 19	....	....	April 26	May 3	....
	1876	April 8	....	April 24 (?)	April 26	April 21	....
	1877	April 9	....	April 30	April 24	April 21	....
	1878	April 9	April 15	April 24	April 23	April 18	May 14
culus acris Crowfoot)	1875	April 29	....	....	March 31	May 11	May 24
	1876	April 29	....	April 24	April 14	April 25	....
	1877	April 30	....	April 26	April 24	Feb. 16	May 17
	1878	April 19	April 18	April 22	March 20	Feb. 16	May 1
reptans	1875	April 25	May 3	May 17 (?)	May 10	May 8	....
	1876	April 25	....	May 5 (?)	April 16	May 4	....
	1877	April 13	....	May 13	May 8	May 12	May 24 (?)
	1878	April 18	....	May 2	April 27	May 1	May 16
UM ROBER- (Herb	1875	April 23	May 4	....	April 26 (?)	May 20	May 13
	1876	April 29	April 33	May 10	May 4	May 3	May 12 (?)
	1877	May 11	Feb. 11	May 21	May 19	May 24	May 31
	1878	April 22	April 21	May 12	May 3	May 6	May 4
m Aparine s)	1875	....	....	June 25	May 3	May 13	....
	1876	May 6	....	May 25	May 18	May 16	June 3
	1877	May 12	n	May 25	May 15	May 24	June 5
	1878	May 3	May 8	May 12	May 4	May 6	June 11
IUM RE- utch Clo-	1875	....	May 2	....	May 15	June 9	....
	1876	....	May 14	May 31	May 28	May 31	June 5
	1877	May 18	...	June 10	June 2	June 8	....
	1878	April 30	May 6	May 14	May 14	May 18	June 10
illa anser- er-weed)	1875	....	....	....	May 13	June 7	....
	1876	May 11	May 22	May 23 (?)	May 18	May 24	May 31
	1877	May 21	.	June 12	May 26	May 25	June 2
	1878	April 26	....	May 17	May 9	May 14	May 18
cornicula- l's-foot) ..	1875	....	May 17	June 22 (?)	May 16	June 6	....
	1876	May 13	May 29	June 10 (?)	May 27	May 30	....
	1877	May 25	....	June 5	June 5	June 7	June 12
	1878	May 14	....	May 19	May 12	May 18	May 21
nthemum *emum*	1875	....	May 14	May 17 (?)	May 16	May 20	....
	1876	....	May 12	May 20 (?)	May 27	May 15	....
	1877	....	May 12	June 1	June 7	May 14	....
	1878	April 19	May 1	May 7	May 16	May 1	June 11

TABLE II.—*Continued.*

No. and Name.	Year.	Yeovil. III.	Strathfield Turgiss. V.	Isleworth. VI.	Marlborough. VII.	Cardington XII.	Great Cotes. XV.
46. *Hieracium Pilosella* (Mouse-ear Hawkweed)	1875	....	....	....	May 16	May 28	....
	1876	....	..	May 23	May 25	May 18	....
	1877	....	....	May 30 (?)	May 15	May 28	....
	1878	May 3	....	May 14	May 12	May 10	....
11. *Lychnis Flos-cuculi* (Ragged Robin)	1875	....	May 4 (?)	...	May 20 (?)	May 23	'May 9
	1876	....	June 1	June 2 (?)	June 6	May 31	May 28 (?)
	1877	May 30	May 25	June 2	June 10	June 8	June 5
	1878	May 17	May 14	May 17	May 14	May 19	May 23
21. *Lathyrus pratensis* (Meadow Vetchling)	1875	....	....	June 27 (?)	May 27	June 1 (?)	June 10
	1876	....	June 6	June 10	June 10	June 13	....
	1877	....	....	June 15	June 16	June 14	June 21
	1878	June 5	......	June 9	June 6	June 10	June 10
5. *Papaver Rhœas* (Red Poppy)	1875	....	May 18 (?)	June 8 (?)	May 21	May 24	....
	1876		June 11	June 11 (?)	June 13	June 7	....
	1877	...	....	June 6 (?)	June 15	June 13	....
	1878	May 14	June 21	May 26	June 6	June 4	June 10
68. *Iris Pseud-acorus* (Yellow Iris)	1875	....	June 3	June 8	May 30	....	June 11 (?)
	1876	....	June 19 (?)	June 12 (?)	June 4 (?)	June 15	June 17
	1877	....	....	June 14	June 14	June 21	June 15
	1878	...	June 1	June 1	May 21	June 2	June 2
26. *Rosa canina* (Dog Rose)	1875	....	....	June 9 (?)	May 30	June 9	June 6
	1876	....	June 12	June 13	June 13	June 9	June 15
	1877	....	June 9	June 15	June 13	June 14	June 21
	1878	June 3	May 13	May 31	May 31	June 7	June 3
13. MALVA SYLVESTRIS (Common Mallow)	1875	. ..	June 13	June 8 (?)	June 5	June 5	June 3
	1876	....	June 12	June 11	June 19	June 18	June 17
	1877		June 21	June 12	June 14	June 16	June 21
	1878	June 6	June 24	June 2	June 10	June 12	June 10
59. *Stachys sylvatica* (Hedge Woundwort)	1875	....	June 18	....	June 9	June 13	....
	1876	....	June 16	June 24 (?)	June 19	June 14	....
	1877	....	....	June 17	June 22	June 18	....
	1878	June 3	....	May 26	June 6	June 6	....
28. *Epilobium montanum* (Broad Willow-herb)	1875	....	June 10	...	June 17	June 24	....
	1876	....	June 11	....	June 21	June 26	....
	1877	....	..	June 16	June 14	June 19	....
	1878	June 8	June 25	June 22	June 10	June 10	....
23. *Spiræa Ulmaria* (Meadow-sweet) ..	1875	....	June 23	Aug. 13	June 17	June 22	June 18 (?)
	1876	....	June 18	June 30 (?)	June 24	June 29	....
	1877	....	June 22	June 24	June 22	June 24	July 2
	1878	June 8	June 19	June 21	June 17	June 18	June 21
42. CENTAUREA NIGRA (Black Knapweed)	1875	....	June 18	....	June 7	June 7	....
	1876	....	....	June 26	June 29	June 16	July 7
	1877	....	....	June 24 (?)	June 28	June 21	July 9
	1878	June 14	June 20	June 1	June 29	June 15	June 22
33. *Galium verum* (Yellow Bedstraw)	1875	....	June 26	July 14 (?)	June 24	June 25	....
	1876	....	July 16	July 3 (?)	June 27	June 27	....
	1877	....	....	July 2 (?)	June 27	June 29	July 9
	1878	....	....	July 10	June 28	June 22	July 4
44. *Carduus arvensis* (Field Thistle) ..	1875	....	June 19	June 30 (?)	July 1	June 26	June 30
	1876	....	. ..	July 5	July 5	July 6	June 22
	1877	....	....	July 3	July 4	July 6	June 27
	1878	June 19	....	June 26	June 29	July 1	June 21
45. *Sonchus arvensis* (Corn Sow-Thistle)	1875	....	Aug. 1	....	July 10	June 18	....
	1876	....	July 27	July 4 (?)	July 5	July 10	July 9
	1877	....	Aug. 14	July 20	July 25 (?)	July 14	July 18
	1878	....	....	July 2 (?)	July 9	June 29	June 2
49. CONVOLVULUS SEPIUM (Greater Bindweed)	1875	....	July 6	July 31	July 10	....	July 7
	1876	....	July 2	July 5 (?)	July 11 (?)	July 16	July 29
	1877	....	July 18	July 4	July 25	July 17	Aug. 6
	1878	..	June 15	July 1	July 14	July 10	July 30

The same mild weather, which had characterised the latter months of 1877, continued during the spring of 1878. The rainfall was below the average during January, February, and March, though during the last 10 days snow fell frequently. April was rather wetter than usual, and May and June were very wet, and August extremely so. In fact, the damp, mild weather, had a very unusual effect upon vegetation. The year was remarkable for *growth*, plants increasing in size, but not flowering as abundantly as in ordinary years. Farmers were unable to keep down the weeds, which seemed to spring up as soon as ever the ground was cleared. Gardens also did not present their usual brilliancy, but remained "green" throughout the season. There were also many abnormal forms of vegetation, flowers turned into a mass of leaves being by no means uncommon.

Fruit, as a rule, has not been plentiful, if we except gooseberies and currants. Blackberries seem to have been unusually plentiful in places, especially at Bishop Frome, where the season was "remarkable for a considerable crop of large and fine-flavoured blackberries; some still remain up to October 31," whilst the first was gathered on August 28.

Another fact worthy of notice is the fact that vegetation has remained unchecked throughout the year. The snows in March, when they *covered* the plants, effectually preserved them from the frost, and thus the *Dog's Mercury* and *Common Nettle*, which are especially liable to be damaged by frost, were as green and fresh when the snow melted as they were before it fell. Again, in August plants generally get killed by the heat and drought, and in September and October a second flowering takes place: this was entirely altered this year. The following figures will give some idea of the results of this unchecked state. It may, however, be premised that the unusually mild March not only made many plants open a few flowers before a time when they might be said to be in flower, but also allowed others to remain on longer than the time when they might be said to have done flowering. All such specimens are called "casuals," and are not reckoned among the total number of plants found in flower in any month :—

	No. in flower at beginning of Month.	Came into flower during the Month.	Total.		No. in flower at beginning of Month.	Came into flower during the Month.	Total.
JAN.				MAY			
1878	27	5	32	1878	120	166	286
1877	30	5	35	1877	85	107	192
FEB.				JUNE			
1878	28	14	42	1878	231	127	358
1877	22	17	39	1877	146	190	336
MARCH				JULY			
1878	45	27	72	1878	299	81	380
1877	35	9	44	1877	230	65	295
APRIL							
1878	68	70	138				
1877	42	49	91				

Upon examination of Table II., it will be seen that plants, as a rule, were later in 1878 than in 1877 during January, February and March, but rapidly became earlier during the rest of the year.

The dates of foliation this year round Isleworth have been much affected by weather; trees of early leafage being brought forward by the mildness of the winter, and checked during March, whilst others coming into leaf later, so as to benefit by the moisture of the ground without check from chill to the young leaves, advanced steadily and luxuriantly.

In the case of the Horse Chestnut the leafbuds were an inch and a-half long, and bursting on March 1 in moist situations by the Thames, but the leaflets did not turn down generally for expansion through the district till April 12; trees in leaf April 30.

Sycamore: bursting bud and a few leaves expanded April 12; trees in damp and overhung situations in leaf by April 24, whilst others had still only a few leaves developed; leafage established May 22.

Maple: sprinkled with leafage May 1; in leaf May 22.

Hawthorn: buds bursting and a few leaves appearing February 21; hedges sprinkled with leafage by April 10; hedges and detached bushes in leaf by April 18.

Ash: in this district decidedly later than Oak in commencement of foliation, the first buds beginning to burst on May 2; first leaves partially expanded by May 6, a sprinkling of leafage developed by May 22, and some trees in leaf by May 27.

Oak: the buds swelled remarkably luxuriantly and steadily, and burst very evenly by April 24; leaves then as much as half-an-inch long, and the foliage advanced rapidly; trees well sprinkled with leafage about three-quarters of an inch in length by May 2; in leaf and exceedingly luxuriant by May 27.

Elm: leaves about half-inch long on suckers on April 6, beginning to appear about the same length on trees April 10; trees sprinkled with leafage April 19; in leaf May 5.

Birch; a few leaves three-eighths of an inch long April 12; sprinkled with leafage about half an inch long April 17; in leaf May 2.

Beech: well sprinkled with leafage May 2; in leaf May 20.

Lime: leaves an inch and a quarter in length; well sprinkled on lower part of trees April 24.

Alder: leaves about half an inch long, thinly sprinkled, April 21; in leaf May 30.

The observations were taken from the same trees noted in 1876 and 1877; still in the same circumstances, excepting in the case of the Limes which (as roadside trees) have been so much lopped as probably to affect the regular progress of commencement of foliation considerably.

From the difficulty of fixing on any definite stage for date in such a gradual process as that of leafage, the word "sprinkled" has been used for the state of the trees when sufficient numbers to be fairly representative of the species are dotted over with leaves; and "in leaf" when the leaves are sufficiently advanced to hide (as when in full foilage) all but the stem and lower part of the main branches.

Comparing the dates of leafage with those from London, to Maldon in Essex, from May 9 to 11, there appears to be little difference (in this particular varying from the somewhat later date of inflorescence at Maldon), except in the case of the Elms which were progressively later in foliage beyond London, till on high ground above Maldon some were still leafless.

Between Isleworth and Reading on May 25 the foliation was, for the most part established; trees under similar circumstances of surroundings (and especially Oak and Ash) varying similarly in development of leafage; and height of ground exercising a marked influence in retarding foliation.

A note from an observer at Braemar on the 18th of June mentions the very few Oaks in the region, and the Alders by the side of the Cluny as then only just bursting into leaf; the first growth there at an altitude of more than 1,100 feet, and at lat. 57° 1′ N, thus nearly corresponding with the date of the second shoot at Isleworth at an altitude of about 70 feet and at 51° 28′ N. lat.

The flowers at Maldon on low ground appeared, where dates could be compared, as in the case of *Ranunculus acris*, *Cratægus Oxyacantha* and *Plantago lanceolata*, rather more than a fortnight later than those at Isleworth.

Between Isleworth and Reading the flowering became more abundant in quantity and early in opening with the progress westward, summer flowers becoming more abundant towards Reading, and some of the spring flowers still noticeable about Isleworth, being less abundant near Reading, or in seed.

The leafage continued remarkably vigorous throughout the season, excepting in the case of Apple Trees, which was, in many cases, thin and poor.

On the 2nd of July the second shoot of Oak and Elm was several inches long; on the 6th some inches long on Hawthorn, and beginning on Lime; on the 9th beginning on Beech, and the Scotch Fir was noticeably healthy in summer shoot.

On the 21st of July many Limes, and the first expanded leaves on some Elms, Hawthorns and Birches were changed in colour, but general alteration appeared checked on the 27th by the heavy rainfall of 1·90 in. during the four previous days.

Limes continued to change. On the 22nd of August Beeches and Horse Chestnuts were turning. On the 5th of September Oak and Birches, on the 15th Sycamore, and on the 24th Ash Trees were beginning to change, the alteration advancing very slowly, but with considerable brilliancy of tint up to the 1st of October, when some Limes were partially defoliated.

The Oaks have been remarkable this season, firstly, for the great size of the buds before foliation, and afterwards for amount of flower, vigorous leafage and good crop of fruit, though, in some cases, the rind was swollen to about three times the usual thickness, enclosing a stunted, decayed fruit, and in others the acorn was unnaturally enlarged and burst its rind, apparently, in both cases, from excess of moisture.

The wet state of ground in the spring appeared, also, beneficial to the Pear Trees, which were remarkably healthy in leafage, excepting on flooded land, where the foliage was not good during the summer, and was turned brown by the 29th of September.

On the 3rd of September the foliage of the district observable along the railway line from Isleworth to Reading was little altered, except with regard to the Birches, which were much turned in the neighbourhood of Sunningdale and Ascot, where they had been in good leaf on the 21st of May, whilst a week later defoliation had so far advanced in some localities along the North London line, where the influence of slightly confined and smoky air acted on the trees, that Limes and others, not specifically distinguishable in passing, were, in some cases, leafless, and in others with the leaves brown, though still adhering.

The characteristic of the Isleworth district this year has been luxuriant leafage and plant growth, but (with some exceptions) no great amount of blossom.

STATE OF FOLIATION FROM ISLEWORTH TO READING, MAY 25, 1878.

Between Isleworth and Hounslow. Elm, Thorn, Willow, Birch, Pear, and Plum in leaf. Apple in leaf, but less forward than Pear, which is remarkably thick and luxuriant.

Hounslow and Feltham. Oak richly in leaf near Hounslow. Horse Chestnut, Birch, and Sycamore in leaf. Poplars and *Robinia Pseud-Acacia* sprinkled. Elm not so forward by Hounslow Heath, nor Oak on wet ground; Lombardy Poplars close by in ordinary leaf. Apples paler and not so deeply foliated as the very luxuriant Pears. Gorse still in bloom on Hounslow Heath, and some Hawthorn. Broom also in bloom on the Heath.

Feltham and Ashford. Weeping Willow in fair leaf. Elm in good leaf. Ash in leaf, and this especially noticeable on some trees, of which a large number of branches were apparently dead or blighted; the rest of the tree appeared consequently earlier. Pear good; Apple later. Young Limes in leaf, but not as luxuriant as young Horse Chestnuts in same circumstances. Willows less forward than at Isleworth.

Corn, Beans, Peas, in several cases poor crops or patchy.

Ashford and Staines. Peas in bloom. Lime in good leaf. Ash in garden in luxuriant leaf. Poplars (? Black Italian) in leaf, but not thick. Spruce Fir vigorous young leafage. Elder in leaf. Ash and Oak tree side by side in slight leaf. Elm not as luxuriant as near Isleworth. Apple still later than Pear.

Staines and Egham. Walnut in leaf, one in warm situation very luxuriant. Elm good and dark foliage. Willow and Lombardy Poplars good. Ash moderately in leaf. Oak and Elm nearly same amount of foliage; leafage luxuriant near Staines. *Robinia Pseud-Acacia* sprinkled.

Egham and Virginia Water. Wych Elm in fair leaf, Alder in leaf, healthy, but not thick on sprays. Elm and Oak about equally advanced. Elm not being as far advanced as in some parts, and Oak leaves hiding all but main branches. Young Sycamores in good leaf, also Hazel and Cherry, Lombardy Poplar and Lime. (Oak north of the line not thick in foliage.)

Chrysanthemum Leucanthemum in bloom, also *Anthriscus Sylvestris, Viburnum opulus* in flower.

Virginia Water and Sunningdale. Birch and Willow rich foliage. Spanish Chestnut in leaf. Elm for a short distance later (? why). Oak leaves not quite hiding as much of the larger boughs. Shoots on Fir (? Scotch) a few inches long. Small Firs much injured (north of the line) by burning heath beneath them. Ash sprinkled. Spanish Chestnut in leaf. Broom in luxuriant bloom.

Sunningdale and Ascot. Mountain Ash in leaf. Apple leafage poor. Shoots approximately 6 to 12 inches long on Fir (? Scotch)—these young healthy trees. Older Scotch Fir shooting a little. Larch in leaf. Oak trees good leaf. Spanish Chestnut in leaf. Near Ascot, Firs north of the line and above a little marsh not showing growth. Oaks sprinkled or in leaf. One Ash with only a few spots of leafage.

Ascot and Bracknell. Fir near line with good shoot. Ash (quite sheltered in trees) in leaf. *Robinia Pseud-Acacia* sprinkled. Birch in luxuriant leafage. Old Scotch Fir wood with abundant short shoots. Larch and Beech in leaf. Willows in good leaf. Oak sprinkled north and south of line. Red Thorn still in bloom. White Thorn blossom, trees near, late in foliage. Spanish Chestnut in leaf. Oak in one hollow in good leaf, sprinkled on rise of ground close by. Broom in flower. Gorse nearly over.

Bracknell and Wokingham. Elm in good leaf. Birch and Beech in leaf. Apple, as near Isleworth. Oak sprinkled; also Ash. Beans not in flower. Corn poor. Oak varying; the scrub still with long red shoots, and of the trees some sprinkled; some in leaf.

Oak in leaf; Lombardy Poplars also. Scotch Fir with slight shoot. Oak not quite so forward. Poplars (? Black Italian) sprinkled.

Wokingham and Earley. Holly with young shoots, two or more inches long, and large numbers of last year's berries. Purple Beech in luxuriant leaf. Elm in good leaf.

Ash sprinkled, in poor leaf, and in leaf up to development of Oak by it. Aspen in good leaf, as well as Oak. Willow plentiful, and in moderate leaf. Birch, good leaf. Larch in leaf. Scotch Fir woods showing little change or of tint on old trees; young Firs with shoots some inches long. Spruce Fir covered with new shoots.

Broom very fine; in bloom. Hawthorn leafage good all the way from Isleworth to Reading.

Earley and Reading. Sycamore, Apple, Birch, Lombardy Poplar, Elm, Willow and Lime in good leaf.

Walnut,Oak and Ash in leaf. Ash sprinkled; also *Robinia Pseud-Acacia.*

Trifolium pratense, and Sarothamnus scoparius in bloom. *Lotus (? corniculatus)* in flower. *Pieridæ* on the sunny side of railway cutting.

Reading. The *flowering* of the plants was rather earlier near Reading than at Isleworth, as shewn by the greater nmmber of early summer flowers out on the railway banks, and by the flowers of the common Hawthorn and Gorse being more numerous and fresher near Isleworth and Hounslow than lower down the line. The foliation was generally about as far advanced as at Isleworth, but varying with circumstances.

The Spanish Chestnuts "in leaf" were almost invariably well sheltered, and especially well-leafed Ash and Walnut were also sheltered.

The latest state of foliation was between Ascot and Bracknell, where the Oaks were still only sprinkled on both sides of the line, and here, also, there were other trees backward in leafage, and Common Hawthorn bushes still in good flower.

The chief amount of trees were Oak and Fir, and of these the Oak leafage, in whatever state of development, was remarkably healthy, and the Fir showed considerable development of shoot on the comparatively young trees near the line, whilst the older ones showed only very short shoots, not long enough to alter the effect of the colour of the more distant woods; these older trees being usually on more exposed ground.

The elevation, whether from drought or exposure, appeared to have great effect on the leafage, also, of the Oaks; the simple difference of being on a bank or in the hollow by it making sometimes what might be reckoned at a week's difference in rate of development.

NOTES ON THE SEVERAL SPECIES.

1. ANEMONE NEMOROSA. II. abundant March 11; IV. several March 2. [Entered March 1 (60)]; VII. first specimen found February 24, next March 2; XII. flowering freely March 10; XVIII. by April 11; the specimen sent indicated a far earlier date for first flower; XIX. plentiful March 16. The date for Addington seems exceedingly late. The specimen from Isleworth was very fully advanced. Comparing the specimens from Marlborough, Redbourne Bury, and Salisbury, the plant seems to have come into flower very nearly about March 5 or 6. It appears to have flowered rather earlier this year than last; in fact to have flowered earlier each succeeding year for the last 4 years.

2. RANUNCULUS FICARIA. II. began flowering as early as December 17, 1877. Specimens found on December 17, 21, and January 16. "Still (February 13) only in bud generally; general February 17;" IV. "three flowers, one with petals fallen," on January 5; on January 21, about 6; VII. first specimen January 9; next January 18; X. February 2 a single flower found; XII. flowering freely February 26; XVII. full March 8; XIX. many February 24; XX. February 17; at Prestatyn, February 28; Colwyn, March 1. The difficulty of deciding the proper date for first flowering of this species has been very great where the plant has been well looked after; some of these early specimens would indicate a rather earlier flowering this year than usual, but the generality of the returns show that it was, as a rule, very late.

3. *Ranunculus acris.* VII. specimens found as early as February 26; XII. flowering April 17. [Entered April 17 (107).] XIII. by May 2. [Entered April 30 (120).] XVI. several April 28. [Entered April 28 (118).] There is still some difficulty about this species, specimens of *R. repens* and *R. auricamus* having been sent. For the last two years early specimens have not been uncommon in some places, especially at Cardington. It is earlier this year than last.

4. CALTHA PALUSTRIS. II. abundant March 11; IV. January 19 "the flowers, of which there were several, were probably on late autumn branches;" full March 4; VI. 8 or 10 plants in flower: March 7 (not general); in flower by the Thames March 19; luxuriant April 26; VII. first specimen February 12; VIII. March 13 "full flower in places;" XII. flowering April 7. [Entered April 7 (97).] XVII. frequent April 16; XIX. February 24, numerous March 7. Very much earlier at Strathfield Turgiss and Cardington, and much later at Great Cotes. Considerably earlier than the average of the previous 13 years at Marlborough.

5. *Papaver Rhœas.* IV. first specimen May 23, next specimen June 5 (second date adopted); XI. "scarlet poppy" June 16; XVII. "plentiful June 9 (? this species);" XIX. about June 10. The dates for this species are very extraordinary. At Strathfield Turgiss it was not seen till June 21, whilst at Yeovil it was observed on May 14, an amplitude of 39 days.

6. *Cardamine hirsuta.* III. by February 18. [Entered February 16 (47).] IV. four plants with seed vessels, several with first flowers, February 9; no more till March 4, when it was plentiful. [February 9 (40) adopted.] VI. a few plants with flower and seed as weeds in Kew Gardens April 6; XVII. flower and seed April 15.

7. *Cardamine pratensis.* XVI. specimens seen March 8. Remarkably late at Babbacombe and Trusham: the specimen sent from the former place was only just in flower.

8. *Draba verna.* II. "abundant" March 3; III. all the year; VI. "a sudden burst after rain" March 2; in bloom March 12; XII. "flower and seed" April 8; XVII. "flower and seed" February 17. [This date adopted.] XX. "quantity" April 7. The specimens from XII. were so advanced that it was impossible to estimate the date.

9. *Viola odorata.* II. by February 24; VI. date estimated by observer; XVII. "full" February 27; XIX. "many" March 2. The date for XII. is very early, if the specimens were wild.

10. *Polygala vulgaris.* II. by May 3; XII. "flower and seed" June 1. [Entered May 30 (50), as the seeds were very young.] XVI. "flower" June 1, very late; XVII. by May 19; XIX. June 30; "not in flower till quite the end of the month;" very late. At Shanklin "several were in flower" on April 22; but they were evidently only recently in flower. Specimens of *P. calcarea* have been sent occasionally, but they have been allowed to stand.

11. *Lychnis Flos-cuculi.* IX. several May 28; XVI. bloom May 25. Very early at Uppingham, and late at Trusham. The specimen from Isleworth

was remarkably fine; and one flower had withered, so that a rather earlier date would probably be more correct. At Salisbury it was "just opening June 5, 1877;" this year it flowered May 14.

12. *Stellaria Holostea.* II. seen on February 28; next date March 10; III. all the year; first *proper* specimen March 28; IV. March 26; "three plants only, but each with more than one flower open;" VII. seen on March 15, 23; next date April 5; XVII. common May 9. The specimens sent show a pretty generally correct date of first flowering.

13. Malva sylvestris. IV. June 7, "possibly June 5" (this latter date adopted); IX. several May 30; XVIII. by June 20. This plant seems to have come into flower first in the neighbourhood of London, and to have spread in both north-east and south-west. It was very late at Strathfield Turgiss.

14. *Hypericum tetrapterum.* At Mudeford (Hants) it came into flower July 2.

15. *Hypericum pulchrum.* VI. seed July 4. The specimen sent seems as if it had been out about a week.

16. Geranium Robertianum. I. by March 10; specimen seen on April 26; next date May 3; XVI. specimen seen March 22; Maldon, May 9. Remarkably late at Isleworth, but the specimen shows only "first flower." It was also extremely late at Addington.

17. Trifolium repens. II. by May 19. Very late at Babbacombe and Great Cotes; remarkably fine specimen from Salisbury. Amplitude very great, from April 30 to June 10—41 days.

18. *Lotus corniculatus.* I. a few May 15. II. by May 25. Late at Trusham and Ware. VIII. June 24 "full bloom."

19. *Vicia Cracca.* II. by June 25. The specimen for Babbacombe was very far advanced, and that from Harpenden rather advanced, indicating earlier dates of flowering.

20. *Vicia sepium.* II. by April 15; VI. by April 27. Maldon, May 10. Very late at Cardington, Babbacombe, and Uppingham.

21. *Lathyrus pratensis.* VI. "in flower" June 9. VII. specimen seen May 18. Very late at Babbacombe and Hatton; the specimens sent indicate proper date given.

22. Prunus spinosa. II. in flower by March 7. IV. specimens seen on January 26 and March 4. XVII. April 7 "bloom killed by frost, probably out 3 or 4 days." This has been most variable in its time of flowering this year; the mild weather was doubtless the cause, specimens kept coming out from January 26 to April 14.

23. *Spiræa Ulmaria.* II. several June 18. VII. specimen seen June 8. Mudeford June 10. Late at Isleworth and Watford.

24. *Potentilla anserina.* Late at Babbacombe and Trusham, and very late at Hatton and Addington.

25. *Potentilla Fragariastrum.* III. all the year. IV. January 5, 21; plentiful March 7. XII. flower and seed March 9. In the South of England this plant frequently came into flower in December; a cultivated specimen at Marlborough was in flower throughout the year.

26. *Rosa canina.* XVIII. by June 12. XX. June 12, at Prestatyn in quantity, some seen near Holywell next day. June 20 at Holywell. As usual, this plant comes into flower very nearly at the same time all over England. This year the amplitude is rather large, May 19 to June 10. It was late at Babbacombe.

27. *Epilobium hirsutum.* XVI. several July 13. Remarkably late at Trusham.

28. *Epilobium montanum.* VI. "in flower" June 22. Very late at Strathfield Turgiss.

29. *Angelica sylvestris.* II. by July 16. VII. by August 1.

30. *Anthriscus sylvestris.* III. all the year, first proper specimen of the year probably March 15. IV. specimen seen February 4. VI. specimen seen February 25. VII. all the year. XII. sparingly March 15. Specimens, as will be noticed from the above records, have been in flower more or less all the year. Even the dates recorded show an amplitude of no less than 57 days.

31. HEDERA HELIX. This plant was unusually late at Marlborough, where many of the flower buds seemed unable to expand, by the end of October many flowers were still unexpanded.

32. *Galium Aparine.* I. a few May 15. Very late at Hatton and Great Cotes. At Uppingham it was "just out, first appeared in a regular way," on May 27.

33. *Galium verum.* XVII. by June 30 "just out."

34. *Dipsacus sylvestris.* VI. in bloom August 11. VII. by July 31.

35. *Scabiosa succisa.* II. by July 15. XV. full flower September 2. It was remarkably early at Hatton (June 29), and was not seen at Bishop Frome till August 22.

36. *Petasites vulgaris.* VI. full April 26; VII. specimen seen January 26; XVII. well out April 15.

37. TUSSILAGO FARFARA. II. abundant by February 13; XII. somewhat abundant March 12; XX. several February 19. Later than usual this year.

38. ACHILLEA MILLEFOLIUM. VI. specimen seen June 7; VII. specimen seen June 4. This species not unfrequently lasts till January, when specimens were seen at Harpenden and Marlborough. At Mudeford it was in flower June 12.

39. *Chrysanthemum Leucanthemum.* XVI. "bloom" May 25. The amplitude of this species is very great, from April 19 to June 11, 53 days.

41. *Senecio Jacobæa.* At Mudeford by June 30. Remarkably early at Strathfield Turgiss [the species is entered again on July 3] and Isleworth, and late at Babbacombe.

42. CENTAUREA NIGRA. VII. specimens seen June 13, 15. At Mudeford by June 28. Very early at Isleworth and late at Marlborough. At Strathfield Turgiss it was seen on June 20, and again entered on July 13.

45. *Sonchus arvensis.* VI. July 4 "apparently open 2 days." XVIII. the specimen from Hatton was in seed, consequently the date of first

flowering ought to be put much earlier than July 26, the date on which the specimen was gathered. XIX. June 2 "many, but must be considered quite abnormal, in a field of self-sown oats allowed to stand from last autumn, consequently have flowered much earlier, nearly six weeks." Remarkably late at Strathfield Turgiss.

46. *Hieracium Pilosella.* II. by May 25. Very late at Fennes (the specimen sent being in the proper state) and at Babbacombe (the specimen sent in this case indicating an earlier date). It seems to have been rather late at Trusham, and extremely late at Addington.

47. CAMPANULA ROTUNDIFOLIA. XVII. by June 30; Mudeford, June 30. Latest at Isleworth.

49. CONVOLVULUS SEPIUM. Remarkably late at Babbacombe.

50. *Symphytum officinale.* VI. in flower May 28; XVII. by May 14. Even allowing a week, the date at Isleworth is still very late.

51. *Pedicularis sylvatica.* II. by May 3 (a week or more); IV. well in flower April 11; abundant April 18; VI. full June 7. Extremely late at Addington.

52. *Veronica Chamædrys.* II. by March 4 "flowering quite freely in a narrow lane, facing west;" IV. specimen seen January 21; V. only date given February 16; VII. specimen seen March 15; XII. flowering April 21; XIX. abundant May 1. The mild winter did not kill the plant down to the ground, hence early specimens have not been unfrequent.

53. *Veronica hederifolia.* II. in flower January 10; III. all the year; VII. all the year; XII. abundant March 4; XIV. January 12 "coming into flower generally." Very late at Addington.

54. *Mentha aquatica.* II. by July 30; VI. in flower August 5; VII. by August 1; XVIII. by August 9; XIX. about August 3.

55. *Thymus Serpyllum.* II. by June 26; XV. fairly in flower July 13.

57. *Nepeta Glechoma.* VI. March 31, "possibly 29th;" VII. specimen found February 23; IX. by March 24; XII. sparse March 15; XX. in quantity April 7.

58. *Galeopsis Tetrahit.* II. by June 11; VII. specimen seen June 22.

59. *Stachys sylvatica.* IV. by June 4; XIII. very abundant June 13. The specimen from Hatton had probably been out a day or two.

60. *Ajuga reptans.* II. flowering freely by April 25; IV. by April 22; XVI. in bloom May 4. This flowered later than usual this year, but the specimens were remarkably fine.

61. PRIMULA VERIS. I. in a few places April 4; III. several March 22; VI. in bloom April 22; VII. specimen found February 28; IX. by March 23; XVI. several March 12; XVII. full March 8.

62. *Plantago lanceolata.* I. by May 15. The specimen had evidently been out a long time. VII. specimen seen April 13; XIII. by May 2; XIV. by May 10; at Shanklin, April 19.

63. *Mercurialis perennis.* II. nearly out January 10; flower by February 13; VII. barren January 31, fertile February 3; XII. abundant February 21; XVII. barren February 25, fertile April 7: XX. nearly out at Queensferry

February 20. Rather later than last year, but earlier, as a rule, than previous ones.

64. *Ulmus montana.* I. by March 12; II. by March 4; V. "elm flower" March 1; "Ulmus montana flower" April 28. The latter seems extremely late, and it is doubtful what species is meant by the former. XII. very plentiful March 8.

65. *Salix caprea.* V. "salix" in flower March 6; VII. by March 10; XII. flowering freely March 4; XIX. by March 18; XX. full March 7.

66. *Corylus Avellana.* I. "barren February 5," "fertile by April 5" (an enormous interval); II. abundant February 18; III. barren January 27, fertile February 5; IV. barren January 21, fertile January 26; V. barren February 12, fertile March 8 (very great interval); VII. barren February 8, fertile February 28; VIII. very late, where also there was "a great want of male flowers"; XVII. barren and fertile February 25. Hazel blossom was very poor and very late this year, and as will be seen the interval between the appearance of the barren and fertile flowers was often very great.

67. *Orchis maculata.* XVII. by June 1. Very late at Babbacombe, and yet the specimen sent was at the proper state.

68. *Iris Pseud-acorus.* I. by June 20. The specimen was far advanced. XVIII. by June 18.

69. *Narcissus Pseudo-narcissus.* II. abundant February 24; VIII. March 7 full flower; XII. double (cultivated) specimens abundant March 8; XIV. cultivated specimens March 2.

70. *Galanthus nivalis.* II. by January 26; III. by January 28; VII. in gardens January 20; VIII. February 14 "full flower, much later than last year;" XIV. in gardens January 29; XVI. full February 22; XX. the specimen was observed at Colwyn. It was invariably later this year than last.

71. *Endymion nutans.* I. a few April 5; II. flowering freely by April 18; IV. by April 11; IX. by April 24; XV. fairly in flower May 5; XVII. April 15 "in the warmest corner of the warmest wood;" XVIII. by May 1.

Frog's Spawn. IV. February 9; hatched March 8; V. March 18; tadpoles April 2; VI. February 18 in enormous quantities in Osterley Park, where it was "more or less present (on March 15) over a space of 54 feet in length by 12 in breath. For about 27 feet in length this is almost a solid mass, some below, some on the surface." VIII. March 10 "spawning;" X. March 19; XII. March 4; XV. March 1; tadpoles, April 12; XVII. March 9; XIX. March 8 (from 7 to 10 days old); XX. March 2.

ORNITHOLOGICAL OBSERVATIONS. BY JOHN CORDEAUX.

Observations have been sent in from twenty-one stations, twenty in England, and one (Colwyn) in North Wales. No observations have been received from stations north of the Humber.

The ornithological notes extend over nine months, from the 1st of January to the 30th of September, 1878.

For convenience we have divided the notes under different headings, as *song*, *migration*, *nesting*.

(1.) SONG.

Skylark (Alauda arvensis). The skylark was heard singing for the first time at I. the last week in January; IV. January 19, several; V. January 19; VI. January 6; X. January 27; XV. middle of January; XVI. January 29; St. Albans February 18; XIX. February 16; Colwyn January 31.

First recorded singing on the 6th at Isleworth in the valley of the Thames. Latest at [XIX.] Great Cotes, February 16 "lark heard singing at daybreak." Appeared to have been generally in song at all stations from Babbacombe to Colwyn from the middle to the end of January.

Great Titmouse (Parus major). Spring note first heard XVI. January 15; XIX. early in February.

Blackbird (Turdus merula). Singing. V. January 27; VI. January 27; XV. January 19; XIX. December 30, 1877, and early in January.

First in the most northern stations, and then gradually southward.

Thrush (Turdus musicus). Singing St. Albans, January 6; VIII. February 2; XV. "almost every day during January"; XIX. throughout January; XX. (November 29, 1877.)

Not sufficient data for any remarks. Song appeared to have been heard at intervals throughout the winter.

Nightingale (Daulias luscinia). Song first heard. Shanklin, April 22; V. April 17; VI. April 17; VII. "before the 12th"; IX. April 17; X. April 22; XII. April 18; St. Albans, April 22; XIII. April 17; XIV. April 19; XV. April 22; XVIII. May 1.

From the 17th to the 22nd inclusive, at the south-eastern stations. Latest at Hatton, Lincolnshire, on May 1. The line of migration of this species is probably from SE to NW, spreading gradually northward and westward after reaching our shores. The males arrive ten or fourteen days before the females.

Cuckoo (Cuculus canorus). First heard. I. May 1 "(said to have been heard earlier)"; II. April 24; IV. April 22; V. April 16; VI. April 17; VII. April 20; VIII. April 19; IX. April 22; St. Albans, April 17; X. April 22; XII. April 25; XIII. April 27; XIV. April 29; XV. April 23; XVI. April 16; XVIII. May 1; XIX. April 26; XX. May 3.

Earliest at V. VI. XVI. Latest XX. and XVIII. Line of migration probably from SE to SW, crossing the warmest part of the straits of Dover, and gradually spreading westward and northward.

Corncrake (Crex pratensis). First heard. XV. May 1; XVI. June 16; XVIII. May 2; XX. April 30.

First at Colwyn, Cardington and Hatton in Lincolnshire. Last at Bishop Frome in Herefordshire.

(2.) MIGRATION.

Chimney Swallow (Hirundo rustica). First seen, I. May 10; IV. April 29; V. April 10; VI. April 26; VII. April 12; VIII. April 30 "in numbers." St. Albans, April 18; X. April 20; XII. April 19; XIII. April 19; XIV. April 28; XV. April 20; XVI. April 12; XVIII. April 19; XIX. April 9; XX. April 13.

Generally a very late arrival of H. rustica. By a curious anomaly seen first at the most northern stations, Great Cotes and Chester, and at Bishop Frome in North Herefordshire. Earliest also at two southern stations, Strathfield Turgiss on April 10, Marlborough April 12. Latest at Babbacombe, Devon, May 10.

House Martin (H. urbica). I. April 19; V. April 27; VII. April 12; XVI. May 4; XIX. May 1. Earliest at the southern stations.

Swift (Cypselus apus). V. May 3; VI. May 17; VII. May 3; VIII. May 9; X. May 9; XII. June 1; St. Albans, April 30; XIV. May 12; XVI. May 9; XVIII. May 22; XIX. May 18.

Cypselus apus very erratic in the time of arrival; at Ware and Odsey (adjoining stations) May 9 and 12, and at the contiguous station Harpenden not till June 1. Earliest [and on the same day, May 3] at Strathfield Turgiss and Marlborough.

Willow Wren (Phylloscopus trochilus). First seen and heard. X. March 1; XVI. April 14; XVIII. April 14; XIX. April 15; XX. April 14.

Almost simultaneously at the northern stations on and about the 14th of April. Is recorded from Ware (X.) March 1, an extraordinary early date if our observer is correct. It is possible in this case (unless the song was heard) that it may have been mistaken for the Chiff-chaff Warbler, a species which is not uncommonly seen as early as the first and second weeks in March.

Flycatcher (Muscicapa grisola). XIV. May 17; XVIII. May 10; XIX. May 14.

Turtle Dove (Columba Turtur). XV. May 12; XVI. May 5; XX. May 4.

Fieldfare (Turdus pilaris). Last seen. XVI. "about a dozen, and several red wings same date." XIX. middle of April. Colwyn "flocks on the hills."

(3.) NESTING.

Song Thrush (T. musicus). V. March 16 "eggs"; VI. March 16 "4 eggs hatched"; XIV. April 13 first eggs. Nearly a month later in the north.

Rook (Building). IV. February 23; VI. March 2; VII. March 4; X. February 24; St. Albans, February 13; XIV. February 25; XV. February 24; XIX. March 10; XX. March 9.

At X. XIV. and XV., contiguous stations, almost simultaneously; about a week later at VI. and VII., and a week later still at the two northerly stations XIX. and XX.

As a rule the spring migrants which visit this country, appear to have arrived considerably after their usual time.

The returns from many of the stations are meagre and unsatisfactory; it is to be hoped that another year our observers will kindly give sufficient data to enable us to draw some reliable deductions bearing upon the particular lines of migration taken by the species enumerated in the instructions. Information is also particularly requested in connection with the first song or spring notes of the species named in the list; the time of arrival of such as visit us in the spring; when last observed in the autumn, and the dates when eggs are first found, stating number and conditions. It would perhaps be desirable to increase the list by adding the names of a few well known species as the Whinchat, Blackbird, House Martin, and Corncrake.

REPORT ON ENTOMOLOGICAL OBSERVATIONS. BY THE REV. C. H. GRIFFITH, F.M.S.

In making my Report of the Entomological Observations of the past year I cannot but regret, that, with the notable exception of the Return from Marlborough, which is admirable in every way, they are so few in number and so meagre in detail, two observers recording only two observations each, and two making but one record! Surely very little pains would have effected a better result than this. I venture therefore to remark that there seems to be a lack of energy and interest in the subject, which I greatly deplore, because I am convinced that all insects might with considerable advantage be observed as weather indicators, and therefore, without in any way interfering with "insects already proposed for observations," or of suggesting new species for that purpose, I would earnestly recommend that more diligent attention be paid to the subject, and that a note be made of "first appearance" of all and every known insect: I should however like to recommend one other class of animals as being worthy of observation, the geometrical spiders. There can be no doubt they are gifted with a remarkable perception of "probable future condition of" atmosphere, indeed M. Q. D'Tijonval has suggested that they are so accurate as weather guides as to be as good as barometers. M. Q. D'Tijonval, in fact, proposes that their *first appearance* should be proclaimed with "sound of" trumpet: without, however, wishing to suggest the adoption of this procedure, there is no doubt that the spiders as well as the insects give so good a general idea of the increase of temperature of Spring that their re-appearance is at all times worthy of observation. In forward Springs I have frequently collected or observed 30 or 40 different species before the 1st of April, in other years I have hardly seen even a honey bee before the end of April or the beginning of May. There is no doubt that the whole class is very susceptible of the return of genial weather, as Spallanzani has observed, their restlessness after so long an absence from food, and their irritability due to their desire to lay their eggs or propagate their kind, induce them to emerge from their hiding places at even a considerably lower temperature than that at which they hybernated in the previous autumn, thus becoming good indicators of alterations of the changes of the seasons. At the same time, I do not attach much importance to the appearances of *Trichocera hiemalis*, as they may be observed all the year through, be the weather what it may, even in the depth of winter, if the air be at all dry or quiet.

All the returns of this year evidence a somewhat earlier appearance of the different species, probably owing to the mild winter and early spring; but all are equally unanimous in their opinion that insects of all kinds have been exceedingly scarce this year: such too has been my own experience; even in the Isle of Wight, all kinds have been equally scarce. This has arisen in my opinion from the character of the weather in both winter and spring. My invariable experience has been that a cold and dry winter is always more favourable to the sustentation of insect life, whereas, a wet and mild winter invariably tends to their destruction, and for this reason, a mild winter and spring tempt the hybernating insects to emerge from their retreats in search of food, and finding none or but little, they soon perish from exposure in the first succeeding pinch of cold. I am also of opinion that excessive moisture kills vast numbers of insects in the pupa state, and the larvæ of eggs hatched too early in a mild season invariably perish.

Another reason to my mind for the scarcity of insect life generally arises from the increased number of birds. The Act of Parliament restricting the times for the destruction of birds, and the licence imposed on guns, has done much to recruit their ranks, and all insects are much kept down in consequence, doubtless, with much benefit to the farmer, but hardly to the delight of the entomologist, as unfortunately, the birds do not discriminate between rare and common species, and all suffer in consequence.

The great abundance of *Colias Edusa* of last year, has been succeeded this season by as great a scarcity. No mention of this butterfly is made in any of the returns, except that it is stated in one report to be exceedingly scarce. I myself have seen only five specimens, two at Strathfield Turgiss, and three in the Isle of Wight.

I append a summary of the observers' notes for this year:—

74. ***Apis mellifica.*** Watford, February 8; St. Albans seen December 31st, 1877; Ware and Salisbury, February, 6; Isleworth, February 7; Cardington, February 18; Odsey, February 18; Trusham, March 8; Strathfield Turgiss, March 5.

79. *Trichocera hiemalis* is reported to have been seen at all the stations on almost every mild day during the months of January and February.

76. ***Pieris Rapæ.*** Babbacombe and Strathfield Turgiss, April 5; Marlborough, April 7; Watford, April 11; St. Albans and Isleworth, April 12; Hatton, April 19; Addington and Chester, April 22; Great Cotes, April 24; Uppingham and Maldon, May 10.

75. ***Pieris Brassicæ.*** Strathfield Turgiss, April 13; Marlborough, April 16; Shanklin, April 22; Trusham, April 25; Watford, April 25; Isleworth, April 27; Cardington, May 1; Maldon, May 10; Uppingham, May 12; Great Cotes, June 18.

78. ***Bibio Marci.*** Addington April 26; Great Cotes, May 8; Strathfield Turgiss, May 10; Isleworth, May 24.

72. *Melolontha vulgaris.* Strathfield Turgiss, April 18; Isleworth and Uppingham, May 12; Great Cotes, June 10.

77. *Epinephile Janira.* Marlborough, May 11; Bishop Frome, June 6; Strathfield Turgiss, June 18; Addington June 23; Babbacombe, June 25; Uppingham, June 27; Isleworth and Hatton, June 28.

Gonopteryx Rhamni. Cardington, March 1; Marlborough, Strathfield Turgiss, and Salisbury, March 3; Addington March 20; Hatton and Trusham, April 12.

Anthocharis Cardamines. Bishop Frome, April 25; Strathfield Turgiss, April 28; Marlborough, May 2; Hatton, May 5; Maldon, May 10.

II. "*Up-bank*" *Thaws.* By the Rev. FENWICK W. STOW, M.A., F.M.S.

[Received October 11th.—Read November 20th, 1878.]

ON one occasion, soon after I first came into Wensleydale, I remarked to a farmer the rapidity with which the snow was at the time disappearing from the hills, although the thaw had made but little progress in the valley. His answer was that it was an "up-bank" thaw, and that "to'opbarnk thow'll sune bring out t'watter." And sure enough the Yore soon came down in high flood.

I took note of the name and of the fact. But it was some time before the phenomenon was again unmistakeably manifested. In the following winter, however, there were two pretty distinct instances of it.

On January 1st, 1875, about 8 p.m., rain fell at the end of a snow storm while the temperature of the air in the valley was 27°, and on the 3rd the ice on the river broke up before the small rivulets in the valley had increased much. Again, on March 6th, the snow disappeared rapidly from the hills, while the valleys still rejoiced in the icy beauties of a "silver-thaw."

Still, I wanted more proof. Considering that a phenomenon which was occasionally perceptible here, where the hills, though rising to 2,300 feet, are seldom more than 1,500 feet above the valleys, ought to be much more easily observed in Switzerland, I wrote to Colonel Ward at Rossinière (Canton Vaud), asking him if he had ever noticed "up-bank" thaws, and if not, requesting him to keep a look out for them.

He replied at first that he had never noticed any such phenomena, but not long after wrote as follows:—

"Up-bank" thaws. I have watched carefully, and on four occasions have noticed, when we had great cold here, that the river was much swollen with snow-water, and the snow was disappearing from the ridge of the Rübli*—then the next day we had a high temperature here in each case, and then heavy rain turning to snow, and frost in the evening.

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* N.B.—The ridge of the Rübli is about 7,000 feet, Rossinière 3,000 feet, above sea level.

I will proceed to give some of Colonel Ward's notes, received subsequently:—

1876.

I. Feb. 15. Hard frost, mountains intensely blue. Peaks steaming, and snow going rapidly off them at 9 a.m. 3 p.m. overcast. Rain 11 p.m.

II. Nov. 11. Intense frost, min. 2°, max. 19°. Cloudless. Snow rapidly leaving mountains at 4 p.m.; ther. 17° here. River down at 9 p.m. 11 p.m. ther. still 15°.

" 12. Intense frost, 15°. Snow gone from mountain tops and trees *above* 1,000 feet level, but not lower down, at 8 a.m. Rain in night, freezing as it fell, trees drooping with ice. Thaw began here at 8·30, and became rapid at 3 p.m.

III. Nov. 30. Hard frost, min. 22°, max. 32°. Snow leaving Cray (6,800 feet), &c. 4 p.m., small stream down. 11 p.m. river down.

Dec. 1. Frost, 26°, but rapid thaw from 8 a.m.

IV. Dec. 17. Frost, 27°, max. 31°. Snow going from Rübli, &c.

" 18. Frost, 30°. 3 p.m., rain.

V. Dec. 30. Frost, 27°. Snow going rapidly from the mountains at 9 a.m. 4 p.m., river *full*.

" 31. Rapid thaw, max. 61°.

1877.

VI. Jan. 4. Frost, 32°. Snow gone from Rübli, &c., at 9 a.m. River and small stream came down at 12.45. Rapid thaw at 3 p.m., and heavy rain in evening.

VII. March 27. Intense frost, 7°. Snow 3 feet thick.

" 28. Less frost, 27°, with snow early. At 12, the grass visible on saddle of Rübli and on Cray, though snow remained thick below. 11·30 p.m. river began roaring.

" 29. 11 a.m. rapid thaw.

It will be observed that in all those instances the snow was seen to leave the mountains, 3,000 to 5,000 feet above the valley, from 6 to 23 hours before the thaw fairly set in at Rossinière, and in instance II. the river came down in flood 18 hours before the thaw commenced in the valley.

Another instance is remarkable. A thaw which was first observed on the mountains and then at Rossinière, did not reach Lausanne, on the lake of Geneva, till many hours afterwards.

"January 20, 1878, min. 12°·7, 9 a.m. 19°·0. Cloudless; river muddy and high. Thaw 3 p.m. 21st. Continued cloudless till evening of 22nd, though thawing fast, with temperature 51°; and though we had this temperature here, at Lausanne it was freezing hard, and some friends telegraphed 'Intense frost, skating going on all day; come at once. Large party skating at Romanel.' I telegraphed back, 'You will have rain at 9 p.m. No use coming.' And sure enough they got it."

There can be no doubt, therefore, about the frequent occurrence of the phenomenon in question, seeing that seven instances of it were observed at Rossinière in a single winter.

The question is whether it is, or is not, the normal condition of the atmosphere at the commencement of a thaw—whether, in fact, a thaw naturally begins above, and is propagated downwards by radiation or convection. Let us endeavour to estimate the *à priori* probability of this happening. It is a fact well known to meteorologists that during the prevalence of hard frost, with calm and clear weather, the temperature is usually, if not invariably, lower on plains and in valleys than on the hills. Although terrestrial radiation is actually more powerful on the hills than in the valleys, owing to the smaller amount of vapour contained in the atmosphere at elevated points, the degree of cold produced thereby is actually much greater in the valleys. The reason is simple. The air chilled by contact with the ground flows downwards, wherever it is possible, owing to its greater specific gravity, and is place is taken by warmer air. This cannot occur on the plains, nor in many valleys; consequently the chilled air remains in contact with the radiating surface, and becomes still more chilled, unless a breeze rises and stirs it up. In Wensleydale, indeed, I have noticed, that on nights of severe frost there is generally a light breeze blowing down each slope of the hills, and a rather stronger one blowing down the main valley, and I am disposed to attribute this to the downward flow of cold air. However this may be, certain it is, that the difference between hill and valley on such nights is quite perceptible to every one's feelings. I have walked down frequently on such nights from the Aysgarth School at a height of 750 feet, to Hestholm, where I lived, which was only 470 feet above sea level, and could not help noticing the increasing chill as I descended. Nor does this chilliness result only from the greater damp, which might deceive our sensations. The thermometer tells the same tale. Sometimes the difference is great, especially if the ground at both stations is thickly covered with snow. Under such circumstances I have known the temperature 22° in Walden at 1,100 feet, and 12° at Hestholm at 470 feet. I have also registered differences of 7° or 8° in the thermometer, where the difference in height was only 200 feet.* The formation of fog in the valley only extends the height to which the

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* Since the above was written the great frost of the present winter has furnished remarkable instances of this. Two will be found mentioned in a letter to the 'Times' of Dec. 17th, 1878; viz. Dec. 13th, when about 9 a.m. the temperature was 11°·5 at the vicarage and 1° in the valley, 200 ft. lower; and December 14th, when the temperatures were 17° and 4° respectively. On Jan. 23rd, 1879, the minimum was 16° at the vicarage and 4°·5 in the valley; on the 27th, 10°·6 and —0°·4; on the 28th 15°·0 and 9°.

Colonel Ward also writes from Rossinière, Feb. 13th, 1879, giving the following temperatures as recorded by him this winter:—

	Chalet.	Bridge 100 ft. lower.	Pond on N side of Valley 80 ft. lower.	Difference.
	(a)	(b)	(c)	a—c.
	°	°	°	°
Min.	2·0	— 2·0	—15·0	17·0
,,	20·0	17·0	11·0	9·0

cold stratum reaches, by propagating the radiating surface upwards. In spite of the heat evolved in the condensation of vapour into fog, it is always colder in the fog than above it, both by day and night. Indeed, I have observed the thermometer above 40° on the top of Penhill (1,800 feet) on a day when the max. at York did not exceed 28°, the plains being covered with a dense fog. In Switzerland, where the dewpoint is very low in winter, no fog is formed. But, fog or no fog, the cold is sure to be greater in winter on the low ground than on the hills immediately above it, whenever the sky is clear and the air calm. Even where the mountains rise to a great height, it is probable that under the conditions stated the ordinary difference of temperature with elevation almost vanishes. Thus Kämtz points out that in Switzerland the difference of level corresponding to a fall of 1°C. was on an average more than half as much again in winter as in spring and summer, and nearly twice as great at 10 p.m. in winter as at noon. And this *average* would of course include cloudy and windy weather, when such inversions of temperature could not occur. It may then be laid down as a general rule that in calm and clear frosty weather the temperature is lower in a valley than at a height above it. What happens, then, when a warm thawing wind approaches? On the hill tops it encounters a temperature not remarkably low, speedily drives the cold air away, and rapidly melts the snow, losing, however, some heat, and precipitating some of its moisture. Beneath lies a valley or plain filled or deeply covered with a dense and cold atmosphere. For some time the warm wind passes over this dense and heavy stratum without much disturbing it, but in passing it is continually sweeping away a portion of the upper surface of the cold stratum, and thus at length displaces the whole of it. In the meantime the temperature in the valley has been raised by radiation from the warm air or mists above, while all radiation into space has been intercepted. Thus at length the thaw reaches the valley or plain. Previously to this, however, first perhaps snow and then hail or rain has been precipitated, the latter at first freezing as it falls, and producing the phenomena of "silver thaw," &c.

The occurrence of "up-bank" thaws will evidently depend in a great

	Chalet. (a)	Bridge 100 ft. lower. (b)	Pond on N side of Valley 80 ft. lower. (c)	Difference. a—c.
	°	°	°	°
Min.	4·0	— 2·0	—15·0	19·0
,,	22·5	18·0	6·0	16·5
,,	18·0	14·5	2·0	16·0
,,	15·0	11	0·5	14·5
,,	15·0	11	1·0	14·0
,,	20	15	3·0	17·0
Noon	23·5	20	17	6·5
,,	33·0	38	38	— 5·0
11.30 a.m.	34·0	21	8	26·0
5 p.m.	31	26	15	16
	29	19	11	18

measure upon the previous condition of *calm and clear weather* being realised. If the weather has been throughout the frost cloudy, and windy, there wil have been nothing to interfere with the ordinary law of decrease of temperature with elevation; the valley will be warmer than the hill, and though the latter will still be *first* affected by the thawing wind, it is scarcely likely that an "up-bank" thaw will result, though the temperature on the hill will probably for a short time be nearly the same as in the valley.

Considering then the very small proportion of fine and clear weather which during the winter season we enjoy in this country, and the frequency of cloudy days even during the prevalence of frost, one cannot be surprised that the occurrence of "up-bank" thaws has seldom been suspected, and still less frequently observed. On the sea-coast they can scarcely occur, except with land-winds. When I lived near the coast at Whitby a thaw was almost sure to follow a shift of the wind to N or NE. And these thaws were never "up-bank" thaws at Whitby, though they sometimes became so in the valleys a few miles from the coast, while frequently in the inland districts the frost was not interrupted. Sleet was the common accompaniment of such thaws,—that is, snow half melted as it falls,—indicating a decidedly lower temperature above. The winter temperature of the sea on the north-east coast being about 40° or more, the air which rests upon it in still weather will generally be above 32°, however severe the frost may be over the land. And the first wafting of this air to the shore naturally causes a thaw, most active at the sea-level, though the real temperature of the N or NE wind may not always have been above 32°. As no part of our islands is far from the sea, such thaws with NE winds are not uncommon even at our inland stations. But they are more frequent in the north than in the south, because the NE wind has passed over much more sea and is therefore warmer. They commonly continue till the sky clears, or till the moist air, which lay over the sea during the previous calm weather, has been succeeded by drier and colder air fresh from Scandinavia. During their continuance snow often falls on the hills, showing their "down-bank" character. I doubt whether they occur on the Continent, and am disposed to consider them peculiar to an insular climate.

What I have observed on the east coast must needs have its counterpart on our other coasts; but as I cannot speak from personal observation, I will not enlarge on the "*down-bank*" thaws of our south and west coasts. In many cases I dare say there would be no thaw, either "down-bank" or "up-bank," simply for want of any previous frost.

But there is one other kind of thaw which I am disposed to think deserves a brief comment. I will quote a description of it by the Rev. W. Clement Ley in a letter to myself on this subject:—"After a sharp northerly wind with hard frost for a day or two, pressure gets very high indeed, the breeze lulls, the atmosphere becomes misty, or perhaps foggy, a dry cloud-bank gradually forms, and temperature slowly rises under and in the middle of a large anticyclone. The frost does *not* return, but after some days, mild, and still (for the time) dry weather, with westerly or southerly breezes, or variable winds, succeeds."

I am not sure that we have the materials at our disposal for tracing the course of such thaws. But it must be remembered that though the Polar wind may have brought a low temperature over that portion of the Atlantic which lies to the N and W of our islands, the water will speedily warm the air as soon as the breeze lulls. We have then a rapidly increasing divergence of temperature over sea and land, and, if this warm sea air becomes in any way intermixed with the air over our heads during the continuance of the anticyclone, clouds will be formed, and a thaw will evidently result. If the anticyclone is propagated in a southerly direction, westerly breezes may be expected, as its northern limit approaches us; and then, if not before, the frost must go. It is probable also that the real temperature of northerly and north-westerly breezes when they arrive at our coasts is seldom very low, except in March and April; the frost results from free radiation assisted by rapid evaporation, and when these are removed, the first by the wind falling, the second by the formation of cloud, a thaw ensues at once. Such a thaw during an anticyclone in this part of England is, I think, frequently, if not generally, of the "up-bank" character, though not very decidedly so. In cyclonic weather, however, this character is sometimes well marked in thaws with NW winds. For example, on January 25th, 1878, I have the following notes:—9 a.m. dry 22°·9, wet 20°·3, wind N, force 3; weather *b*; in night snow, snowdrift, min. 22°·2, wind N, force 6; max. of day up to sunset 28°; then strong wind and warmer. 9 p.m. dry 34°·7, wet 33°·0, wind NNW, force 7; weather *b*. Next morning, slight thaw in night; snow much melted on hills; thaw till afternoon, then frost again.

Again there is the common spell of hoar frost, lasting generally a couple of days, but occasionally for more than a week, accompanied usually by magnificent weather among the hills, but by dense fogs in the plains. It is a matter of common observation that in such cases the formation of cloud, or the rising of a breeze from any quarter whatever, will generally bring a thaw. The frost being the result of radiation, and the atmosphere generally being neither particularly cold nor dry, such thaws may properly be considered to begin from above, supposing that there has been any frost at all above to be thawed.

The true and typical "up-bank" thaw, however, generally approaches from SE, S or SW, after a really hard frost with splendidly calm and clear weather, such as we had at the end of December, 1874. The thaw which followed was undoubtedly of this type, as I have said. But for obvious reasons such thaws often elude observation. Either no rain is precipitated, or the precipitation occurs too early to possess the liquid form; the hills are shrouded in mist, and so the disappearance of the snow from them cannot be seen from below; and there is not always a stream at hand which is speedily affected by the "up-bank" thaw. Again, the interval between the times of commencement of the thaw above and below may often be very short and so escape observation, and in insular climates this will very frequently be the case.

At present, therefore, I cannot assert the "up-bank" thaw to be the normal type of such phenomena in any part of our islands, but I am disposed to think it will be found to be so at continental stations generally.

I hope I shall not be thought to have unjustifiably taken up the time of the Society in a discussion, which for want of proper means of observing the atmospherical conditions at a height, must be conducted in a great measure by hypothesis and conjecture. But let me ask, Why have we no means of such observation? Surely it is not because they are not wanted. It may be that on the sea-coast the atmospherical conditions above and below are more nearly alike than elsewhere. But even a few miles inland our meteorological observations, which have now attained the acme of elaboration, tell us very little about the conditions which are producing those phenomena which at 4 feet above the ground we are diligently registering. Climatology is one thing and meteorology another. Meteorology is concerned with causes, climatology only with the registration of facts. Meteorology is, or should be, a science. But what science is there in meteorological averages? Just as much as there is of medical science in the Registrar General's returns of births, deaths, and marriages. Both may be, and ought to be, material for science. By all means let us have statistics, but not imagine them to be science.

Now we know a great deal about climate. If all the self-recording observatories and every one of our other stations were to be shut up to-morrow, it would be no great loss to climatology—we know all about averages.

For *meteorology* we require strictly synchronous observations, both at different stations, as we already have, and what is still more important, at *different heights*. There are difficulties in the way of course, both real and imaginary. But the advantage of a few *elevated stations* furnished with *careful observers*, each having a corresponding observatory near the sea-level, would be immense. The conditions productive of thaws and thunderstorms; of nimbus, stratus, or cumulus cloud; the connection of dryness with "visibility," and with intensity of radiation both solar and terrestrial; the conditions attendant upon the condensation of rain, and the formation of hail; and, in a word, almost every question in meteorology would have light thrown on it. You might as well study climate in a coal-pit, as meteorology only at four feet above the ground.

I have ventured to point out an urgent want, but I will not presume to dictate the best means of supplying it. But where other nations have taken the initiative, it is a reproach to England that she is not even prepared to follow. Surely it is time that the matter was taken up, and with vigour, unless we are prepared to confess the truth of the reproaches which are freely levelled from all sides at meteorologists.*

* REMARKS ON THE ABOVE BY COLONEL WARD, DATED ROSSINIERE, FEB. 13, 1879.—"In these observations I never noticed the Cray alone, as it is exposed to the sun. The ridge of the Rübli runs NE and SW, and is protected from the sun by the mass of the Gumfluh; Rocher du Midi faces north, and so does Planachand. The latter and the

DISCUSSION.

Mr. **Budd** could corroborate Mr. Stow's remarks by his own observations in the west of England. He had noticed several times that although even shallow ponds in the vicinity of Exeter had only a thin coating of ice, yet a deep pond, which lay in a valley at Fordlands, only four miles from that city, was covered with thick ice, so that skating went on there for several days together. He believed that "Up-Bank Thaws" were produced by an upper current of air coming from a different quarter, generally from the SW, and thus denoting the approach of a cyclone.

Mr. **Whipple** said that simultaneous observations had been taken at Kew at the top of the Pagoda, about 120 feet above the ground, and also at about 20 feet above the ground, and it had been found that during a dense fog the temperature at the top of the Pagoda had been found nearly as much as 10° higher than that only 20 feet above the ground; this was especially the case at night. He would like to know if "Up-Bank Thaws" were more frequent on hills running from E to W, having a southern aspect, and also if the species of rock had any effect upon them.

Mr. **Strachan** thought that the direction and inclination of the hills upon which these thaws were observed should be stated, for upon them depended in some measure the effect of the sun's rays. It should not be overlooked that Mr. Glaisher's balloon-ascents, made in the fall of the year, showed that a warm upper current often existed at a considerable elevation. Sir G. Back, during his terrible drift down the Frozen Strait in 1836-7, observed the temperature at the masthead, and found it occasionally warmer than on the deck. Such warm currents may account for these up-bank thaws.

Mr. **Laughton** referred to a short paper in a recent number of the 'Comtes Rendus,' giving a comparison between the temperatures observed at the summit of the Puy-de-Dome and at Clermont. The temperatures at the upper station are described as being generally *less* than those at the lower, but as being not unfrequently *greater* during the night; so that the curves for the 24 hours curiously intersect each other.

Mr. **Harrison** had found that the summit of Leith Hill in Surrey was often warmer than the lower land which surrounded it. He believed that "Up-Bank Thaws" were due not only to the direction of the wind, but also to the change in the direction of the stratum of air which enveloped the hill.

Mr. **Marriott** remarked that he had sometimes noticed that the temperature on the grass at 9 p.m. was 2° or 3° above the minimum which had occurred at 7 or 8 p.m., the sky being quite clear, the barometer rising or steady, and no change in the conditions to prevent radiation being apparent. The next morning the barometer was falling, and the Weather Report showed that a depression had approached Valentia. He believed that a warm moist upper current of air must have set in during the evening and so intercepted radiation.

Rev. W. C. **Ley** thought Mr. Stow's paper a valuable and suggestive one.

Rübli ridge are the best guides, as they are grass and not rocky, and never see the sun. The river is also an excellent guide, as it rises in a glacier facing north, and is fed entirely by streams rising in the same way. It has no tributaries of importance from the south.

"I have observed the following 'up-bank' thaws in the course of this winter:—

"Nov. 24. Min. 16°. 9 a.m trees 1,500 ft. up clear of snow. River full and thick. Noon, thaw.—Dec. 16. Min. 9°, max. 24°. 5 p.m. snow going from mountains and trees high up.—Dec. 17. Min. 23°, max. 33°. Cray green at 9 a.m , and grass visible on other mountains.—Dec. 18. Min. 21°, max 24°. Peaks steaming in afternoon.—Dec. 19.—Min. 6°, max. 35°. 9 a.m. 15° *river down*. 4 p.m. thaw.—Dec. 25. Min. 8°, max. 23°. 9 a.m. snow going from mountains. 3 p.m. *river down*.—Dec. 26. 9 a.m. thaw.—1879, Jan. 10. Min. —9°·3. Grass —22°·2. Max. 16°; in sun 87°. Cloudless. Snow going from mountains at 9 a.m. 11 p.m. river down.—Jan. 11. Min. 5°, max. 32°·5. Thaw 9 a.m.—M. F. Ward."

[It will be observed that the above "up-bank" thaws synchronise nearly with thaws experienced in one part or another of the British Islands.]

He wished to call further attention to the phenomena of thaws occurring in the centres of anticyclones, and mentioned some instances in which the rise of the thermometer-curve corresponded in a marked manner with the rise of the barometer-curve. He thought that the relative warmth of the weather in our winter anticyclones, as compared with the weather in similar conditions on the Continent, was due to the usual density of the cloud-banks in our winter anticyclones, the result of our insular position. While admitting the value of mountain stations, he considered that atmospheric phenomena observed on mountains can rarely be taken as representing those which occur at the same level over a plain. For the ultimate solution of the problems connected with these latter phenomena he could only look to the use of captive balloons for meteorological purposes.

Mr. SYMONS stated that the Society had recognised the importance of and already possessed some hill stations, amongst which might be mentioned Dartmoor, 1,400 feet high, and Buxton, 1,000 feet. Mr. Sopwith and Mr. Glaisher established many years ago two stations in Northumberland, one at the Allenheads lead mines at an altitude of 1,400 feet high, and the other only a few miles distant at the village of Bywell not 100 feet above sea level, and several hill stations have also been established by the Scottish Meteorological Society; in fact, plenty of observations have been made, but unfortunately little has been done towards utilising them.

The Rev. F. W. STOW said that Wensleydale was a limestone district, but the tops of the hills were of millstone grit. The general direction of the hills was from E to W, and undoubtedly the difference of aspect was not without its effect in sunny weather; but he did not think that either aspect, or geological formation, had any appreciable effect in producing the phenomena of these thaws.

III. *Comparison of Thermometric Observations made on board the Cunard R. M. S.S. 'Algeria,' by* Captain WILLIAM WATSON, F.M.S., *on a voyage between Liverpool and New York in August and September*, 1878. Compiled at the Meteorological Office, and communicated by Captain H. TOYNBEE, F.R.A.S.

[Received October 10th.—Read November 20th, 1878.]

THE description of the style and exposure of observations will be best explained by the following extract from Captain Watson's letter:—

"Enclosed I send some observations of temperature taken during my last voyage; they have all been taken and read off by myself, and the readings are to a tenth of a degree. The Meteorological Office Screen* containing dry and wet bulbs is placed on top of the deck-house, freely exposed to the air-currents, and when the sun is shining protected from its rays by a small awning spread for the purpose, but with this precaution the day readings are too high owing to radiation from the decks. Two other thermometers (dry and wet) are placed in a screen of my own, which is made of inch pine, and perforated in every part but the top with half-inch holes; this box containing the thermometers is in every instance taken to that part of the ship which is in shade, and where there is no artificial heat, where it remains for ten minutes, during which time I am trying the temperature with the sling thermometers, and if there is any difference—say more than 0°·5 between the sling thermometers and those in the box—I try somewhere else until I get them as near together as possible; as a mattor of course always taking the lowest temperature, for there is more difference than I was aware of in different parts of the ship. After recording observations by the sling thermometers, and by those in my own screen in the most suitable part of the deck, my screen with its thermometers is hoisted to the mizen-peak, and occasionally to the mizen-mast-head, and after remaining aloft ten minutes on a cloudy, and five minutes on a sunny day, is then lowered, and the thermometers read off."

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* The M. O. Screen is made of thin deal with single louvre sides and bottom, the sloping of the louvre is arranged to exclude rain and the direct rays of the sun; there is also ventilation at the top. This form of screen is not all that could be wished, since it has to be sheltered itself from the sun's rays, but it is the best that has yet been devised considering the circumstances.

Table I. gives the results deduced from all observations irrespective of hours; the observations have been made at corresponding times for all the different exposures:—95 sets of observations have been used in the comparison.*

TABLE I.

M. O. Screen.*					Sling Thermometer.				
On the top of Deck-house.					On the most suitable part of the deck.				
Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.
°	°	°	In.	o/o	°	°	°	In.	o/o
61·5	58·6	2·9	·452	83	60·7	57·4	3·3	·426	80

Captain Watson's Screen.										Sea.
On the most suitable part of the deck.					60-70 feet above sea.					Surface Temp.
Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	
°	°	°	In.	o/o	°	°	°	In.	o/o	°
61·0	57·8	3·2	·433	81	60·2	57·0	3·2	·420	81	63·2

* The letters M. O. are used when alluding to the Meteorological Office screen.

Table II. gives a comparison of temperatures at 110 feet above sea level with those on deck, &c., from 19 sets of observations:—with the exception of observations at 110 feet these figures form part of the data used in Table I.

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* The corrections have been applied to the readings, and were found by very careful comparisons made by Captain Watson at a time coincident with the experiments.

TABLE II.

M. O. Screen.					Sling Thermometer.					Captain Watson's Screen.				
On top of Deck-house.					On the most suitable part of the deck.					On the most suitable part of the deck.				
Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.
°	°	°	In.	o/o	°	°	°	In.	o/o	°	°	°	In.	o/o
61·2	57·8	3·4	·431	80	60·5	56·7	3·8	·409	78	60·7	57·2	3·5	·420	79

Captain Watson's Screen.										Sea.
70 feet above sea.					110 feet above sea.					
Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Surface Temp.
°	°	°	In.	o/o	°	°	°	In.	o/o	°
59·8	56·0	3·8	·397	77	59·2	54·9	4·3	·375	75	63·1

TABLE III.

Hour.	M. O. Screen.					Sling Thermometer.				
	On top of Deck-house.					On the most suitable part of the deck.				
	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.
	°	°	°	In.	o/o	°	°	°	In.	o/o
3, 4, or 5 p.m.	59·9	57·1	2·8	·427	84	59·5	56·3	3·2	·410	81
8, 9, or 10 a.m.......	60·6	57·6	3·0	·433	83	59·7	56·3	3·4	·408	80
1 p.m.......	62·8	59·2	3·6	·452	79	61·4	57·8	3·6	·429	79
5 or 6 p.m.......	62·0	58·8	3·2	·450	81	61·3	57·5	3·8	·422	78
8 or 9 p.m.	61·5	58·4	3·1	·445	81	60·9	57·3	3·4	·426	80
Mean	61·4	58·2	3·2	·441	82	60·6	57·1	3·5	·419	80

Hour.	Captain Watson's Screen.										Sea
	On the most suitable part of the deck.					60-70 feet above sea.					
	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Surface Temp.
	°	°	°	In.	o/o	°	°	°	In.	o/o	°
3, 4, or 5 a.m.	59·8	56·8	3·0	·420	82	59·1	56·0	3·1	·406	81	61·9
8, 9, or 10 a.m.	60·1	56·9	3·2	·419	81	59·2	55·6	3·6	·394	79	62·3
1 p.m.	61·6	58·0	3·6	·432	79	60·9	57·2	3·7	·417	78	62·1
5 or 6 p.m.	61·6	58·0	3·6	·432	79	60·8	57·0	3·8	·413	78	63·7
8 or 9 p.m.	61·2	57·8	3·4	·431	80	60·6	57·0	3·6	·415	79	63·5
Mean	60·9	57·5	3·4	·427	80	60·1	56·6	3·5	·409	79	62·7

Table III. has been constructed from the observations with the view of exhibiting the values for the different hours; in all 50 sets of observations have been used—*i.e.* 10 sets for each separate result; the same days have been dealt with in each set, the period handled being between 25th August and 14th September, 1878. All observations, except those for 25th August, were made onthe homeward passage.

Captain Watson's remark that thermometers in M. O. Screen are affected by radiated heat from the decks is borne out by all the results; it will, however, be noticed that the maximum influence on the mean at midday only amounts to about 1°: a comparison has been made of the individual observations made with M. O. Screen and Captain Watson's Screen on deck; there are only four instances out of 95 comparisons in which the difference amounts to 2°, and these were all on the outward passage, and all at about midday; they are as follows:—

		°	Weather.			°	Weather.
August 21	1 p.m.	+2·5	b c	August 25	1 p.m.	+3·2	b
„ 23	1 p.m.	·+2·5	o	„ 26	1 p.m.	+6·1	b

The last difference is quite exceptional, and is probably due greatly to the fact of the observation being made at or near the meeting-place of the Gulf Stream and Arctic Current; considerable difference may here be due to the fact that all the observations are not made at *exactly* the same time. It must not be lost sight of that the observations were made on board a steam ship, where difficulties of exposure exist which are altogether foreign to a sailing vessel, due regard having to be paid to the heat from funnel, &c.

As a comparison of *screens*, the results may be considered to show a very satisfactory agreement, and speak well for the ordinary screens used by the Meteorological Office. It must, however, be borne in mind that Captain Watson is a very careful observer, who provides a special awning for his screen, and is extremely particular as to the fitting and cleanliness of the wet-bulb thermometer, and to the dry-bulb being *really dry* at the time of observation.

With respect to the influence of height above sea level, the air temperature at 60 to 70 feet above sea, which may be considered about 40 feet above thermometers on deck, is shown by all three tables to range about 0°·8 lower, due to elevation; this difference does not seem to be influenced by the time of day, though, of course, more observations are needed before coming to a definite conclusion.

The vapour tension and relative humidity range lower at 60-70 feet than on deck; and both have the maximum vapour tension and minimum relative humidity at the hottest part of the day.

The observations at 110 feet above sea, given in Table II. show a further decrease of 0°·6 for the increase of 40 feet in height; they also show a further diminution in both vapour tension and relative humidity.

The temperature of the sea is shown by all the comparisons to be slightly higher than the air temperature—say to the extent of about 2°.

The original observations are in the Meteorological Office, and can be consulted by any Fellow wishing to see them.

DISCUSSION.

Mr. WHIPPLE wished to know how long the thermometers were allowed to remain at the masthead, and also how long it took to lower them, for he considered that they were likely to change their readings, if sensitive instruments, before reaching the deck. He did not believe that good results could be obtained with a wet-bulb thermometer which was swung round in the air, as the muslin was liable to get dry, and then too high a temperature would be obtained.

Dr. TRIPE remarked that the sea temperature observations showed a range in the day of 1°·8, the range of air temperature at the masthead was the same, and the swing thermometer 1°·9, but the Meteorological Office screen gave 2°·9. He would like to know at what depth the sea temperature was taken, as it agreed so closely with the temperature of the air.

Mr. STRACHAN explained that the small difference between the air and sea temperatures was probably due to the observations having been made in different parts of the ocean, and the averages of all taken. The sea temperature is observed by drawing a bucket of water from alongside where it cannot be influenced by the ejection water from the engines, and standing a thermometer in it for two or three minutes. Captain Watson's observations at the masthead also occasionally show a higher temperature than on deck.

Mr. SYMONS showed from Table III. that the Meteorological Office screen was heated up by the sun, as its thermometers then reached a much higher temperature than any of the others.

Mr. CASELLA said that these sea temperature observations were due to a suggestion of Captain Maury at the Brussels conference. This had no doubt led to the subsequent observations which had resulted in our present accurate knowledge of the temperature of the sea at its various depths, from which it appeared that we must soon become acquainted with the law of the circulation of the waters of the ocean. No doubt this was Captain Maury's desire at the time he instituted these observations. The part taken by the Kew Observatory in verifying instruments at an early stage of these proceedings had been of the utmost service, and he thought that we were also under deep obligation to nautical men such as Captain Watson, for giving such an amount of time and care in pursuit of this important branch of physical investigation.

Mr. C. HARDING said that Captain Toynbee, who was unavoidably absent, wished him to mention that he believed more such comparisons may prove the sling thermometer to be a very valuable instrument both for dry and wet bulb observations, and that better relative values would be obtained from the use of such thermometers on board ship, and probably at land stations, than from instruments in a fixed screen. Captain Toynbee had communicated with Captain Watson respecting the amount of change due to lowering the screen, and it was not considered that the observations would be perceptibly influenced by this; the Meteorological Office had now supplied him with a turn-over thermometer, with the object of detecting any difference caused by the action of lowering the screen. Mr. C. Harding said that the individual observations only showed the lowest temperature at the lower level on two or three occasions. Up to the present time one uniform screen has been used on board ship, so that one is not troubled with the difficulties arising from the use of different screens as on land; in his opinion the results obtained by the swinging thermometer, as shown in this paper, were highly satisfactory, both with regard to the air temperature and the evaporation temperature, but he was reluctant to recommend the use of the swinging thermometer for the evaporation temperatures until further trial had been made with it.

IV. *Experiments with Lowne's Magnetic Anemometer.* By Captain William Watson, F.M.S., Cunard Steam Ship 'Algeria.'

[Received August 6th.—Read December 19th, 1878.]

This instrument consists of a detached fan, carrying a bar magnet on the same axle, and acting on a steel pin connected by an endless screw and pinion with geared work immediately below. All the geared work is protected from any action of the air or water by being enclosed in a strong brass casing; to the lower part of this casing a dog-vane can be attached, and the whole can then be pivoted upon the end of a light brass rod 15 inches in length, having a weight at its lower end to keep the instrument upright when exposed to the action of the wind: at three-fourths of the distance from the weight to the dial there is a socket on which the whole works; a short or long handle can be fitted in this, whichever is most convenient for observing. There is a brass cap to put over the fan whenever the wind velocity exceeds 2,000 feet per minute, and so cut as to reduce the revolutions of the fan one half.

This instrument is so delicate that when held over the steam heater, in my deck room, it immediately commenced to revolve from the upward movement of the heated air.

The apparent direction of the wind was observed by the smoke from the funnel and by the dog-vanes at the mastheads; the true direction by the wavelets on the water, when light, when strong, by the lines of foam always present whenever the wind velocity exceeds 23 miles per hour.

The force of the wind was always noted by Beaufort's scale, the corresponding velocities being those adopted by the Meteorological Office. I may notice in passing, that White, in his 'Naval Architecture,' page 473, gives force 6 as corresponding to a velocity of "from 15 to 20 knots," and force 5 to a velocity of 14 knots.

After using the instrument for some little time, I found the vane, rod and weight of no use, in fact, they did positive harm; with light winds aft and the ship rolling, say up to 15°, the vane took charge and the instrument did nothing but go round; with a light beam wind, if the ship was rolling, a somewhat similar result followed; with a fresh or strong breeze the instrument oscillated to such a degree as to render the reading doubtful. After the first few experiments, I discarded the rod and weight, but retained the vane, pivoting the instrument on a wooden rod; for moderate weather this answered very well, but whenever there was much motion I was obliged to take the vane away and secure the instrument so that it could not move. I then placed it perpendicular to the apparent direction of the wind, this I found to answer better than any other method, in other words, I obtained a greater velocity by this latter method than by the others.

I have no doubt this anemometer with vane, rod and weight attached, will answer very well on shore, where the platform is a steady one; but after a long series of observations, taken in all weathers, I am of opinion the vane is all that is required for sea use, and that only in light winds and smooth water.

I found the instrument when used with the brass cap did not give the velocity of the wind as half that given by the instrument with the fan freely exposed, as a rule, it showed 3 per cent. less than it should have done.

This instrument has been roughly used—in fair weather and in foul it has been exposed, not for minutes but for hours, and it has stood the test well; divested of its many parts it has done good, and, as I think, reliable work; but when used at sea it must be placed where there are no eddy winds, but where the wind is blowing true or as near true as it can do near the deck and deck houses of a large steamer; with very little care it is a valuable instrument for measuring velocities up to 45 miles per hour.

I have used the above anemometer for 20 months. It has given satisfactory results from force 1 to force 7; above the latter force the fan goes round with an increasing velocity, but the register refuses to follow it: this is easily accounted for. As the power of the magnet is a constant force, or one nearly so, and the resistance of the geared work an ever increasing one, there must be a point where they will neutralise one another; this point lies somewhere between the velocities of 42 and 47 miles per hour. When the resistance is greater than the power of the magnet, the magnet slips past the steel pin, giving motion to the wheel work, and the velocity as given by the register is very much understated.

The following are a few of the observations taken with the above anemometer:—

1876, Nov. 30th.—Wind E by N, force 5·5 = 31 miles per hour; wind right aft, sea confused and ship rolling heavily; apparent velocity by anemometer 10·7 miles, speed of ship 16·3 miles per hour; velocity by anemometer 27 miles per hour; the instrument was on the top of the wheel-house and five feet above it.

This is a good result, considering the conditions under which the observation was taken.

Dec. 3rd, 10 a.m. to noon.—Wind W, force 7 = 40·5 miles per hour, one point on starboard bow; sea west, 20 ft. high; ship not rolling; apparent velocity by anemometer 47 miles; speed of ship 7·6 knots = 8·7 miles per hour; velocity 38·3 miles by anemometer; the instrument was on the starboard side of the bridge and 6 ft. 6 in. above it.

Dec 7th.—Wind W, force 7 = 40·5 miles per hour, one point on starboard bow; sea west, 18 ft. high; in the two hours the anemometer registered 92·2 miles, the ship making 11·7 knots = 13·5 miles during the same time; true velocity 39·3 miles an hour by anemometer; instrument on starboard side of the bridge and 6 ft. 6 in. above it.

Dec. 17th, 10 a.m. to 11 a.m.—Wind WSW, force 3 = 18 miles per hour; velocity of wind by anemometer 30 miles per hour; speed of ship 12 knots = 14·15 miles; corrected velocity 15·85 miles by instrument; wind one point on port bow.

Dec. 18th, 10.30 a.m. to 11.30 a.m.—Wind W by N, force 5 to 6 = 31 miles per hour; apparent direction of wind N 52° W; velocity by anemometer 20 miles per hour; course of ship N 60° E, 16 miles per hour; true direction of wind N 82° W, 30 miles per hour.

Wind W, force 7 to 9 = 40·5 to 56·5 miles per hour; one point on port quarter; anemometer showed 81·6 miles; speed of ship 16 miles; velocity of wind 47 miles by anemometer, in my opinion an under-estimate of 5 miles per hour, as the wind seldom moderated to force 7; and some of the squalls went up to force 10 during; the time the instrument was exposed it was very squally, with thick snow and the ship rolling heavily; the instrument was on top of the after wheel-house and 5 ft. above it.

And so on during the whole of last year the results were equally good, and there was no falling off during the two voyages made in the present one.

1878, Feb. 24th.—Wind SW, force 1·5 = 10·5 miles per hour; anemometer showed 9 miles.

March 1st.—Wind W by S, force 5 = 28 miles per hour, nearly right ahead; velocity by anemometer 37·2 miles; speed of ship 9 knots = 10·4 miles per hour; true velocity 26·7 miles per hour.

April 1st.—Wind N W, force 8 = 48 miles per hour; velocity by anemometer 43·6 miles.

April 2nd.—Wind W, force 2 = 13 miles per hour; velocity by anemometer 14 miles.

April 4th.—Wind E, force 7 = 40·5 miles per hour; velocity by anemometer 38·3 miles.

I have given the results as shown by the anemometer, the force of the wind has been estimated without any regard being paid to the velocity as shown by the instrument. In many cases the force has been estimated by the officer in charge of the deck at the time of observation, with a like close result.

In spite of the drawbacks stated above, I look upon this instrument as the best that has yet been produced for velocities not exceeding 45 miles per hour.

DISCUSSION.

Mr. LOWNE, in a communication to the Secretary, explained, in reference to Captain Watson's paper, that he had no doubt the unsatisfactory performance of the instrument at high velocities of wind was due to the magnet having lost some part of its magnetism, and not having been re-magnetised as it is intended to be in such circumstances. This cause of faulty performance has been anticipated and provided for in the fittings of the instrument, as will be immediately seen on reference to the description of the instrument printed in the Quarterly Journal, Vol. II., page 286. In that communication the following passage occurs :—"One practical objection that presented itself in this form of instrument when it was first planned was the danger of the small magnets losing too soon their magnetic power. After much thought and experiment, this objection has been entirely obviated by the very simple expedient of having a powerful magnet so arranged in the case of the instrument as that its poles act inductively upon the small magnets whenever it is placed away in the case, and so maintain the magnetism of the small fan-wheel permanently. The large magnet has soft iron projecting at right angles into the case in such a manner that these soft iron poles lie close to the poles of the fan-wheel magnet when within the case. The large magnet has an armature of soft iron fixed across its steel poles, so that the full force of the large magnet is only brought to bear upon the small fan-magnet when this armature is temporarily removed." In other words, the effective state of the magnet is to be preserved by occasionally drawing back a sliding lid at the bottom of the case, removing the armature of the horse-shoe magnet, and then replacing the instrument in the case, and so leaving it for a time. The small magnet is then re-magnetised by induction.

When this is accomplished the armature is returned to the poles of the horse-shoe magnet, in order to enable it to retain its magnetic force. Captain Watson does not appear to have been properly informed of, or to have adopted, this precaution. He is now, however, fully instructed in the matter. If the re-magnetisation of the small magnet is not effectively accomplished by this procedure, the fan may be taken out by removing three screws on the rim of the tube, and the small bar magnet may then be magnetised by actual contact with the poles of the horse-shoe magnet. Mr. Lowne further stated that when the instrument was first returned to him he was under the impression that the aluminium fans had stood their work of exposure well. Further examination, however, proved that this was not the case, and that the aluminium was much damaged by corrosion. On this account an instrument has since been constructed for Captain Watson with silver fans, having a silver centre running upon sapphires, and with due correction provided on account of the greater weight of the fans. Captain Watson's report is very satisfactory, on account of the evidence it affords that the main object contemplated in this instrument, the preservation of the indicating parts from corrosion, has been effectively secured by the expedient of closing them up hermetically in their air-tight case, and of only allowing the movement of the fans to be transmitted to them through the brass wall of the closed case by magnetic influence.

Mr. PASTORELLI said that his experiments with anemometers had been very limited. He had tried both the large and small anemometers of Dr. Robinson's pattern under rather unfavourable circumstances. The radii of their arms varied from 6·75 inches to 2 inches, while the cups varied from 3·5 inches to 1 inch diameter. One of the anemometers had vanes, or fans. Those of Robinson's form give similar readings, the greatest difference being about 6 per cent. The fan arrangement he found to be unsatisfactory; in shifting or chopping winds it gave a higher velocity than the Robinson's, but in a steady, direct current the latter gave the highest velocity. He felt sure that the cup arrangement will be found the most perfect for giving the wind's velocity. Careful experiments that he had made with the Robinson's cups in water proved to him that they travel one-third the rate of the current. These experiments were made in still water, the apparatus being carried with uniform steadiness over a measured distance; the cups described one-third of the space. This was repeated twelve times with a like result, the difference of readings never exceeding 5 per cent. When the lower cup was acted upon instead of the upper, its reading was 5 per cent. higher. He was disposed to think that if the cups were made proportional to the weight of the arm and spindle, the readings of such anemometers, if correctly made, would prove to be satisfactory.

Mr. SCOTT said that many comparisons had been made with anemometers, and amongst others those by Dr. Dohrant in a large riding school at St. Petersburg, where a whirling arrangement had been fixed, but instruments of different sizes had been found to differ widely. Dr. Robinson had obtained a grant from the Royal Society in order to help him to work out the friction constants, and he had found that two precisely similar anemometers placed on a house only four yards apart did not run together. He believed that the best anemometer for use at sea was that employed by Dr. Mohn, in the Norwegian Expedition, and described in the Journal of the Society, which consisted of a small Robinson's anemometer fitted on a handle, with a trigger. The observer started the instrument by his watch, and took the observation at the expiration of half a minute. It was obvious that an instrument requiring such a precise measurement of time was not suited for telegraphic observers.

Mr. C. HARDING said, that doubtless Captain Watson was an admirable observer and the results given by him could not be questioned; the agreement obtained was, however, very remarkable, since the various Tables for the conversion of Beaufort's scale into miles per hour differ immensely among themselves. Probably Captain Watson had used Mr. Scott's Table for the conversion; this was deduced from careful observations, and agrees well with tables given by some other authorities. The following will, however, show some very important differences which exist :—

Beaufort Scale.	Speed of Ship under favourable conditions.	Equivalent Velocity of Wind in miles per hour.		
		[*] Mr. Scott.	[†] Sir Wyville Thomson.	[‡] American Log.
1	—	8	1·5	1-2
2	1-2	13	2	4
3	3-4	18	4·5	9
4	5-6	23	8	14
5	—	28	12·5	17
6	—	34	18	20
7	—	40	24·5	24
8	—	48	32	30
9	—	56	40·5	40
10	—	65	50	67
11	—	75	61	80
12	—	90	72	100 and upwards.

With Beaufort force 2, the American log says that a full rigged ship with wind on her quarter would sail 2 to 3·5 knots, whereas they only give 4 miles per hour as the equivalent velocity of the wind. The above seems sufficient to show that the present understanding with respect to Beaufort forces is not all that could be wished.

Mr. WHIPPLE thought that it was a great pity that such a delicate instrument should be used at sea, as it was liable to derangement from the great strain put upon it. A number of experiments had been conducted with Robinson's anemometers at Kew, and it had been found that their size materially altered the results.

Captain TOYNBEE had not the slightest doubt as to the correctness of Captain Watson's observations, and thought that meteorologists were much indebted to him for them. Captain Watson takes special interest in such work, but we could not expect to get such careful observations of ship's course and speed, apparent wind direction, and the number of revolutions in a given time, made by an instrument in a part of the ship free from eddies, each time that a record of the wind was required from ordinary observers; so that we should have to be satisfied with the estimates of wind direction and force which seamen can obtain from the tops of the sea, drift of clouds over heavenly bodies, trim of the yards, and the amount of sail carried; these estimates being generally very correct even in steamers. He thought it would be well to try this valuable little instrument at land stations, which are free from the complications caused by ship's course and speed. The hermetically sealing up of the works seemed to him very valuable.

Mr. R. CURTIS said that in the description given of the instrument in the Journal for 1874 it was stated that the registering portion did not work properly with higher velocities than 90 miles per hour, which was considered to be a higher velocity than was ever likely to be met with. He believed, however, that this rate per hour was more frequently attained, and even exceeded, than most people imagined, the common practice being to confuse the *rate per hour* with the total number of miles *completed during the hour*—two very distinct things. Even the ordinary anemograms from exposed stations occasionally showed clearly that for periods of 10 or 15 minutes the wind had been blowing at the rate of 120 or more miles per hour, and for shorter periods even 150 miles per hour. If, as not seldom happened, an instrument registered 70 miles as having been completed during an hour, that amount was the sum of the varying rates—the alternating gusts and lulls—of the wind, and it was clear that the maximum force of the gusts must be something very much greater, and the minimum of the lulls much less, than this total amount. He thought these considerations would probably account for the fact that in strong winds the instrument failed to give a sufficiently high result, since the *crests* of the gusts would be cut off owing to the instrument failing to record, and the total registered would of course be too small in consequence.

Mr. EATON remarked that the movement of the atmosphere at the earth's surface was greatly retarded by friction. The long horizontal distance sometimes traversed by a balloon, which had ascended in a calm, and after a rapid flight shortly descended to the earth at a distant spot under a similar condition of the atmosphere, was a proof of this. He considered that the high velocities of the wind, to which reference had been made, were quite possible, though perhaps not in such positions as those in which existing arrangements enabled anemometers to be placed. This latter circumstance was unfortunate, as many important atmospheric changes were brought about without much movement of the air near the surface of the earth to indicate their advent. As an instance he might mention a case of not unfrequent occurrence, when, during a frost, an irruption of warm air from above was about to displace the comparatively stagnant air at the surface, and produce a thaw.

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[*] "Instructions in the Use of Meteorological Instruments," p. 58.
[†] "Voyage of the 'Challenger.'" Vol. I., p. 161.
[‡] Meteorological Journal issued in 1878 by the U.S. Hydrographic Office, p. 7.

V. *Meteorology of Bangkok, Siam.* By J. Campbell, Staff-Surgeon R.N.

[Received November 5th.—Read December 18th, 1878.]

The following observations were made at Bangkok, the Capital of Siam, during the years 1858-1868, omitting 1862. A glance at a map of Indo-China will show that that kingdom, Muang Thai, the Land of the Free, has a geographical position such as to preserve it from the heat, deluges of rain and devastating cyclones so common to adjoining countries; the elevated land of the Malayan Peninsula, Burmah and the Gulf of Siam, contributing largely to an anomalous state of things, and which meteorologically considered will be apparent in the tables herein given.

The instruments employed were partly private during the first four years, but they were compared at Kew with standards. The last six years' records were entirely from those supplied by the Meteorological Department of the Board of Trade. The rain-gauge during the first four years was of my own construction. Up to April, 1859, the barometer was a mercurial one—Government—but it got out of order, and till 1863 I depended upon an aneroid. This instrument evidently deteriorated yearly, though slightly. It is, however, evident that the first two instruments were originally at a less height than the barometer of the last six years. Up to May, 1859 the instruments were placed in the north verandah of a floating house, 7 ft. above tidal influence, the rain-gauge 20 ft. above the river, so as to be higher than the houses and completely secluded from the sun; after the above date they were placed, for a time, in a large airy room of my house on land, and subsequently in its north verandah, at an elevation of 21 ft. above high water level. The rain-gauge was at an elevation of about 45 ft., but for the last two years it was only 8 ft. above high water. These changes of elevation ought, theoretically considered, to have a disturbing influence on the regularity of the items recorded, excepting the barometer; but such does not appear to have ensued to any appreciable extent.

Barometer.—The pressure of the atmosphere attains its maximum in December, sometimes in January, and then falls till June, July or August, when its minimum is reached; these are uninfluenced by any local causes, an unusual inundation, much rain, drought or heat having no observable effect

Months.	Pressure.	10 a.m.	4 p.m.	Mean.	Means of		Absolute		10 a.m.	10 p.m.	Mean.	10 a.m.	10 p.m.	Mean.	10 a.m.	10 p.m.	Mean.	Total.	Max.	Rain.	Thunder storm.	Clear Sk	Overcast.	Lightnin	N.	NE.	E.	SE.	S.	SW.	W.	NW.
					Min.	Max.	Min.	Max.																								
	In.	°	°	°	°	°	°	°	In.	In.	In.							In.	In.													
January	29·932	74·4	84·7	76·5	70·2	85·5	63·9	90·5	·676	·750	·713	79	80	79	1·5	1·0	1·3	..	..	1	0	14	2	0	23	4	2	0	3	..	..	..
February	·932	77·7	86·1	79·0	73·8	87·1	69·5	90·0	·801	·808	·804	84	83	83	3·3	0·5	1·9	..	..	2	1	1	0	9	..	4	1	1	12	..	..	..
March ..	·865	81·6	89·0	82·3	76·8	91·1	72·0	94·0	·824	·889	·856	76	81	78	2·7	1·0	1·9	2·17	1·00	5	5	3	4	17	2	7	5	1	31	3	2	..
April	·842	84·8	87·9	82·9	77·3	91·0	74·2	96·4	·872	·895	·883	73	83	78	3·2	2·6	2·9	4·69	2·96	15	10	6	8	16	8	3	5	0	20	17	4	..
May	·799	83·9	86·8	82·2	77·4	90·2	73·0	93·5	·913	·913	·913	79	87	83	4·5	4·5	4·5	13·25	2·39	20	11	0	7	13	2	2	1	0	28	16	12	..
June	·759	84·2	87·8	83·1	78·5	90·8	76·0	95·0	·896	·914	·905	76	83	79	4·9	5·5	5·2	4·11	1·21	16	4	0	5	18	..	..	..	1	7	27	12	..
July	·761	82·7	87·1	82·4	78·1	90·2	75·2	96·0	·883	·899	·891	79	85	82	5·4	6·6	6·0	11·86	2·77	21	11	0	11	13	3	..	1	1	8	14	14	..
August ..	·739	82·5	87·5	82·2	77·6	91·2	75·0	96·0	·873	·897	·885	78	84	81	5·5	5·0	5·2	6·81	1·55	21	11	3	7	6	3	..	..		1	10	20	1
September	·754	81·1	85·4	80·8	76·6	88·2	74·0	94·0	·871	·902	·886	82	88	85	6·0	6·9	6·4	6·53	1·58	19	9	0	12	4	5	1	..	1	3	4	9	4
October ..	·809	81·5	85·7	81·2	76·9	87·5	73·0	92·5	·886	·923	·905	86	87	86	6·1	5·0	5·5	4·94	1·10	20	7	0	10	21	11	1	13	2	2	4	4	3
November	·966	75·3	81·3	75·5	70·0	82·2	63·2	86·2	·628	·692	·660	71	78	74	2·8	1·6	2·2	0·07	0·07	2	0	16	2	6	27	1	9	..	..	..	..	..
December	29·914	76·8	85·1	78·0	72·6	85·9	67·3	91·0	·692	·758	·725	73	77	75	2·6	0·9	1·8	0·17	0·09	3	1	23	1	1	14	4	13	.	1	..	..	..
Year ..	29·839	80·5	86·2	80·5	75·4	86·4	63·2	96·4	·818	·853	·835	78	83	80	4·0	3·4	3·7	54·60	2·96	145	70	66	69	124	98	27	50	7	116	95	77	8
1859.																																
	In.	°	°	°	°	°	°	°	In.	In.	In.							In.	In.													
January	29·914	74·2	83·9	75·2	68·4	84·6	61·0	88·8	·620	·682	·651	73	79	76	2·0	0·0	1·0	..	..	0	0	15	0	0	14	..	11	2	2	1	..	1
February	·933	79·2	87·2	79·9	74·2	87·9	68·9	91·0	·776	·805	·790	77	80	78	5·5	0·0	2·7	1·14	0·38	7	4	5	5	0	2	..	10	7	6	2	1	..
March ..	·866	81·9	89·5	82·6	77·3	90·4	68·3	93·0	·839	·860	·849	77	79	78	5·5	0·0	2·7	0·14	0·06	6	3	6	2	4	1	1	12	2	10	4	3	1
April	·823	81·5	89·4	82·6	77·8	91·7	70·0	95·0	·825	·849	·837	75	78	76	5·6	2·0	3·8	0·06	0·06	3	9	2	2	5	3	1	7	..	11	13	..	1
May	·746	83·3	87·5	83·7	80·3	88·3	76·5	94·0	·818	·858	·838	71	74	72	6·0	4·0	5·0	4·24	1·55	15	15	0	9	21	5	2	..	..	17	19	..	1
June	·750	82·8	86·3	82·8	79·4	86·9	76·9	90·5	·844	·857	·850	75	78	76	5·3	5·0	4·1	6·12	1·49	17	12	3	9	7	2	1	..	1	34	7	10	..
July	·717	81·7	85·9	82·2	79·0	86·5	75·0	90·0	·841	·867	·854	78	78	78	6·3	5·4	5·7	4·61	0·83	19	8	1	12	13	1	..	1	...	21	11	4	1
August ..	·752	81·5	86·1	81·7	77·6	87·0	75·5	91·5	·852	·892	·872	77	82	79	6·7	7·4	7·0	7·32	1·93	19	16	0	14	2	2	1	4	..	11	20	3	
September	·762	81·0	85·3	80·8	76·3	87·0	73·9	89·5	·837	·867	·852	78	80	79	6·0	7·0	6·5	10·02	3·68	19	19	0	10	6	4	2	2	..	4	19	5	2
October ..	·784	79·6	83·4	79·7	76·0	85·1	74·3	88·0	·788	·840	·814	81	82	81	6·0	6·7	6·3	3·87	0·97	19	8	0	10	8	10	2	3	1	3	5	12	..
November	·873	77·1	82·8	77·5	72·4	83·5	66·5	88·0	·700	·770	·735	74	76	75	3·1	3·4	3·2	3·08	1·24	6	3	6	1	0	31	9	5	..	..	..	..	1
December	29·921	73·0	81·0	73·7	66·9	81·1	60·2	85·0	·646	·678	·662	80	80	80	1·5	1·0	1·2	0·58	0·58	1	0	11	2	0	17	8	4	2	1	1	..	1
Year ..	29·821	79·7	85·7	80·2	75·4	86·6	60·2	95·0	·782	·818	·800	76	79	78	4·9	3·5	4·1	41·18	3·68	131	97	49	76	66	92	27	59	15	120	102	38	9

1860.

Months.	Mean Pressure.	Air Temperature.							Tension of Vapour.			Relative Humidity.			Amount of Cloud.			Rainfall.		Weather, No. of days of					Wind, No. of Observations of							
		10 a.m.	4 p.m.	Mean.	Means of Min.	Means of Max.	Absolute Min.	Absolute Max.	10 a.m.	10 p.m.	Mean.	10 a.m.	10 p.m.	Mean.	10 a.m.	10 p.m.	Mean.	Total.	Max.	Rain.	Thunder Storm.	Clear Sky.	Overcast.	Lightning.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
	In.	°	°	°	°	°	°	°	In.	In.	In.							In.	In.													
January	29·874	76·8	84·1	77·3	70·5	84·7	62·5	87·5	·728	·775	·751	78	80	79	3·2	2·4	2·8	0·59	0·36	3	0	6	1	2	10	7	4	2	8	..	..	2
February	·841	79·6	86·5	80·2	73·6	87·4	67·5	90·0	·821	·875	·848	81	82	81	2·8	1·4	2·1	..	..	2	4	9	1	5	7	4	0	2	29	..	1	..
March ..	·768	81·5	87·7	82·2	76·4	88·7	70·0	91·5	·818	·844	·831	75	74	74	5·2	3·7	4·4	0·52	0·16	6	8	5	4	11	1	2	2	1	46	1	6	..
April	·761	83·0	88·7	83·7	78·4	89·9	73·0	93·0	·830	·880	·855	73	74	73	4·4	2·8	3·6	1·84	1·51	8	9	7	6	19	4	2	6	..	41	1	3	..
May	·679	81·6	85·3	81·6	77·7	86·9	73·0	90·0	·877	·894	·885	81	82	81	6·9	6.4	6·6	15·66	3·42	25	19	0	12	17	11	1	4	1	30	1	2	..
June	·663	81·5	85·5	81·5	77 6	86·5	74·0	89·0	·872	·882	·877	81	82	81	6·5	7·0	6·7	11·91	2·47	20	15	0	17	16	..	..	2	..	15	14	10	1
July	·708	81·3	84·6	81·4	77·2	85·7	74·2	88·0	·838	·846	·842	78	81	80	7·0	7·0	7·0	7·93	1·70	23	13	0	13	12	..	..	2	1	41	5	2	..
August ..	·695	81·6	86·7	82·2	77·9	87·3	75·0	91·0	·839	·871	·855	78	77	77	6·2	5·7	5·9	4·27	1·01	16	7	2	8	6	..	1	..	..	23	11	11	..
September	·706	79·4	83·8	79·8	76·0	84·3	73·2	87·0	·822	·852	·837	82	83	82	7·4	8·0	7·7	15·18	1·98	27	15	0	12	8	1	1	2	.	15	13	9	3
October ..	·790	80·0	83·7	79·9	75·4	84·4	72·9	88·8	·834	·858	·846	78	83	81	7·0	7·7	7·3	12·14	1·95	25	14	0	11	16	10	8	3	3	..	9	9	1
November	·851	77·5	81·7	77·7	73·5	82·6	64·0	87·4	·756	·785	·770	80	81	80	5·0	5·4	5·2	2·38	0·68	12	9	2	5	12	30	5	2	..	3	1	4	1
December	29·891	74·3	80·7	75·5	70·9	81·3	64·5	85·4	·644	·685	·664	75	75	75	2·0	1·0	1·5	..	..	4	0	14	0	0	39	1	..	..	..	..	2	1
Year	29·769	79·8	84·9	81·0	75·4	85·8	62·5	93·0	·806	·837	·821	78	79	78	5·3	4·8	5·1	72·42	3·42	171	113	45	90	124	113	32	27	10	242	56	59	9

1861.

Months.	Mean Pressure.	Air Temperature.							Tension of Vapour.			Relative Humidity.			Amount of Cloud.			Rainfall.		Weather, No. of days of					Wind, No. of Observations of							
		9½ p.m.	3½ p.m.						9½ a.m.	9½ p.m.		9½ a.m.	9½ a.m.		9½ a.m.	9½ p.m.																
	In.	°	°	°	°	°	°	°	In.	In.	In.							In.	In.													
January	29·833	77·4	84·5	78·5	73·0	84·8	68·5	87·5	·701	·743	·722	74	74	74	2·2	0·8	1·5	0·27	0·27	3	1	13	0	2	15	2	7	2	5	1	3	2
February	·826	75·1	82·8	77·0	71·6	83·8	63·2	90·0	·666	·728	·697	76	74	75	3·5	1·6	2·5	0·75	0·52	6	0	9	2	0	13	10	4	1	10	..	2	..
March ..	·782	81·4	88·0	82·5	77·7	88·3	74·0	90·5	·833	·844	·839	77	75	76	5·1	1·5	3·3	2·35	2·35	6	7	3	2	11	..	5	3	1	36	2	2	..
April	·712	80·2	85·2	81·0	76·9	87·0	73·0	91·0	·849	·866	·858	82	79	80	5·5	5·4	5·4	4·04	1·00	20	19	2	6	16	11	11	4	..	13	1	5	..
May	·658	82·0	86·5	82.4	78·4	87·3	73·9	93·0	·884	·910	·897	79	81	80	7·2	8·0	7·6	10·61	3·68	20	15	0	11	8	6	2	..	1	15	9	9	3
June	·690	81·6	85·0	81·5	77·9	86·3	76·0	89·0	·924	·952	·938	85	88	86	5·6	8·0	6·8	9·88	5·28	23	17	0	11	12	..	1	1	1	30	9	4	3
July	·714	81·3	84·5	81·0	77·7	85·8	74·3	90·0	·851	·899	·875	80	86	83	6·5	7·0	6·7	7·17	1·39	16	8	0	7	9	..	..	..	1	23	15	6	..
August ..	·684	80·8	84·8	81·0	77·5	85·5	75·7	90·0	·820	·849	·834	78	80	79	6·0	7·0	6·5	3·36	1·12	20	5	1	7	11	..	..	1	..	15	16	7	..
September	·687	80·4	83·5	80·4	77·5	84·9	74·8	89·0	·866	·871	·868	83	85	84	7·6	8·4	8·0	8·82	1·32	26	8	0	10	6	4	2	3	..	22	8	4	4
October ..	·737	79·6	83·1	79·6	75·7	83·6	71·6	87·5	·803	·845	·824	79	83	81	6·0	6·0	6·0	6·69	1·57	17	6	2	8	4	16	6	1	..	4	4	5	1
November	·826	79·8	82·7	79·3	75·8	84·0	68·9	87·0	·798	·803	·802	77	87	80	4·2	3·3	3·7	7·26	1·16	10	10	8	5	8	21	9	2	2	1	..	1	..
December	29·935	75·4	80·6	75·8	71·6	81·2	62·8	85·5	·674	·688	·681	75	76	75	3·4	1·4	2·4	0·17	0·08	4	3	9	1	1	23	3	1	..	5	..	1	..
Year ..	29·757	79·6	84·2	80·0	75·9	85·2	62·8	93·0	·805	·833	·819	78	80	79	5·2	4·8	5·0	61·37	5·28	171	99	47	70	88	109	51	27	9	179	65	49	13

Months.	Mean Pressure.	Air Temperature.							Tension of Vapour.			Relative Humidity.			Amount of Cloud.			Rainfall.		Weather, No. of days of					Wind, No. of Observations of							
		9½ a.m.	3½ p.m.	Mean.	Means of		Absolute.		9½ a.m.	9½ p.m.	Mean.	9½ a.m.	9½ p.m.	Mean.	9½ a.m.	9½ p.m.	Mean.	Total.	Max	Rain.	Thunder Storm.	Clear Sky.	Overcast.	Lightning.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
					Min.	Max.	Min.	Max.																								
	In.	°	°	°	°	°	°	°	In.	In.	In.							In.	In.													
January	29·997	75·7	82·8	76·6	70·3	82·9	64·0	86·5	·641	·709	·678	71	73	72	4·0	1·0	2·5	..		0	0	8	0	0	24	6	2	..	..	..	..	..
February	·892	79·7	86·4	80·3	74·0	87·9	70·0	91·5	·800	·824	·812	79	77	78	5·3	2·2	3·7	0·45	0·25	6	3	3	4	12	8	5	1	..	5	3	..	1
March ..	·867	84·3	88·8	83·1	77·0	90·4	70·5	93·0	·881	·885	·883	74	79	76	2·0	2·1	2·0	2·83	2·75	5	8	12	1	22	3	4	3	..	43	5	..	1
April	·809	83·8	89·0	83·1	76·9	90·9	73·5	95·0	·845	·868	·857	73	79	76	3·1	2·3	2·7	3·97	1·63	8	5	7	4	20	4	..	3	6	27	8	4	4
May	·785	84·0	86·5	82·1	76·8	88·9	73·5	92·0	·830	·843	·836	71	80	76	6 0	5·2	5·6	6·58	1·40	17	15	1	6	16	1	..	..	..	20	26	2	1
June	·762	84·0	85·7	82·0	77·0	89·1	73·0	95·0	·834	·843	·838	71	79	75	6·1	6·5	6·3	11·36	2·20	18	11	0	9	16	..	..	..	..	1	51	3	..
July	·752	82·9	86·6	81·7	77·1	88·6	73·5	93·0	·846	·864	·855	75	84	79	6·7	6·0	6·3	8·25	1·00	20	11	0	11	12	..	..	..	..	..	49	7	1
August ...	·774	82·6	85·3	81·2	76·5	88·0	73·5	93·0	·824	·854	·839	74	82	78	6·0	6·2	6·1	7·75	1·50	18	10	2	8	13	..	..	1	1	10	29	11	2
September	·791	82·2	84·1	80·1	75·7	86·0	73·8	88·5	·854	·862	·858	81	86	83	6·5	7·5	7·0	11·45	2·00	23	10	0	12	7	4	2	3	2	7	20	9	..
October ..	·862	80·0	84·3	79·6	74·8	85·7	71·0	89·5	·802	·844	·823	78	83	80	4·5	4·8	4·6	6·53	2·10	14	6	3	5	8	19	10	4	1	1	2	1	8
November	·953	76·1	80·8	75·2	69·2	82·0	61·9	88 5	·658	·685	·672	72	78	75	4·0	4·0	4·0	2·25	0·80	8	2	7	3	4	23	13	3	3	4	1	1	1
December	29·983	73·4	81·5	73·4	65·8	82·4	59·0	86·0	·557	·610	·583	67	74	70	1·6	1·4	1·5	..		0	0	13	1	0	32	14	3	..	..	..	..	..
Year ..	29.852	80·7	85·1	79·8	74·2	86·9	59·0	95·0	·781	·807	·794	74	79	76	4·6	4·1	4·3	61·42	2·75	137	81	56	64	130	118	54	23	13	118	194	38	19
1864.																																
	In.	°	°	°	°	°	°	°	In.	In.	In.							In.	In.													
January	29·933	75·3	83·5	75·2	67·3	85·0	59·5	91·0	·633	·656	·644	71	75	73	3·2	4·1	3·6	..	..	2	0	7	2	0	18	2	16	2	6	5	1	1
February	·948	73·0	84·8	74·7	66·0	86·0	58·0	88·5	·651	·681	·666	68	77	72	2·4	1·0	1·7	..	..	0	0	12	0	0	2	8	6	2	12	15	2	..
March ..	·938	81·0	87·3	80·3	73·1	88·6	68·0	91·0	·770	·789	·780	72	77	74	4·2	3·2	3·7	..	..	5	6	2	1	6	1	1	11	3	26	10	1	..
April	·827	84·5	91·3	84·1	77·4	92·7	73·0	96·0	·830	·860	·845	70	75	72	3·1	2·1	2·6	..	..	0	0	10	1	4	..	..	.	2	51	1	3	..
May	·842	82·5	88·5	82·1	75·6	90·9	72·0	94·5	·824	·859	·842	74	78	76	5·3	5·0	5·1	4·38	2·62	12	13	0	5	18	1	2		1	24	9	2	2
June	·810	83·7	87·3	82·2	76·6	90·2	74·0	93·5	·817	·864	·840	70	81	75	6·0	5·2	5·6	6·21	1 90	17	8	0	8	15	..	.	..	..	9	39	2	..
July	·789	81·6	84·5	80·4	76·2	87·4	72·0	92·0	·836	·841	·838	78	81	79	7·0	7·0	7·0	4·18	1·13	23	5	0	14	4	..	..	..	3	8	30	4	1
August ..	·815	82·5	86·0	80·9	75·6	88·4	72·0	93·0	·850	·840	·845	72	83	77	6·0	6·0	6·0	4·98	1·60	16	8	0	14	14	..	1	..	1	8	23	18	2
September	·832	81·7	83·2	79·8	75·6	86·8	73·0	90·0	·832	·861	·847	77	87	82	7·0	7·0	7·0	9·61	2 90	25	10	0	15	8	7	5	1	4	3	19	8	2
October ..	29·930	81·1	84·8	79·9	75·0	86·8	71·0	91·0	·826	·853	·840	77	86	81	5·6	6·0	5·8	9·64	2·30	14	5	1	8	10	22	8	4	3	5	11	2	2
November	30·017	77·5	84·6	76·6	68·1	85·2	63·5	90·0	·605	·669	·637	63	73	68	1·0	1·2	1·1	..	..	2	1	17	0	0	33	8	7	..	..	..	2	4
December	29·994	77·3	85·3	77·1	68·7	87·1	61·5	90·0	·665	·710	·687	70	76	73	1·8	2·0	1·9	..	..	2	0	11	0	0	11	17	7	1	..	..	..	3
Year ..	29·889	80·1	85·9	79·4	72·9	87·9	58·0	96·0	·761	·790	·776	72	79	75	4·4	4·1	4·2	39·00	2·90	118	56	60	68	79	95	52	52	22	152	162	45	17

1865.

Months.	Mean Pressure.	Air Temperature.							Tension of Vapour.			Relative Humidity.			Amount of Cloud.			Rainfall.		Weather, No. of days of					Wind, No. of Observations of							
		9½ a.m.	3½ p.m.	Mean.	Means of		Absolute		9½ a.m.	9½ p.m.	Mean.	9½ a.m.	9½ p.m.	Mean.	9½ a.m.	9½ p.m.	Mean.	Total.	Max.	Rain.	Thunder Storm.	Clear Sky.	Overcast.	Lightning.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
					Min.	Max.	Min.	Max.																								
	In.	°	°	°	°	°	°	°	In.	In.	In.							In.	In.													
January	30·048	74·6	84·6	74·1	64·3	83·9	59·0	87·0	·561	·628	·594	65	75	70	1·0	0·4	0·7	0·06	0·06	1	..	9	0	0	1	8	4	2	2	2	..	..
February	29·931	81·2	86·9	80·1	72·7	87·8	67·0	91·0	·780	·801	·790	73	79	76	3·0	2·0	2·5	..	..	3	..	9	2	0	..	..	1	5	38	11	1	..
March ..	·911	84·9	89·8	84·0	78·7	91·3	73·5	96·0	·826	·854	·840	68	76	72	3·8	5·5	3·6	..	..	1	1	3	3	10	..	1	1	4	45	9	..	..
April	·860	85·7	91·0	85·1	79·7	92·4	74·0	94·0	·878	·908	·893	71	78	74	4·5	3·6	4·0	0·75	0·75	5	7	2	2	14	2	..	..	2	41	13	..	2
May	·835	83·4	87·9	82·2	76·3	90·6	73·0	96·5	·843	·876	·860	73	82	77	5·2	6·0	5·6	8·86	1·50	19	20	1	14	19	3	..	2	3	24	10	9	4
June	·788	83·8	86·9	82·7	78·2	89·3	74·5	94·0	·869	·886	·877	75	81	78	6·5	5·3	5·9	5·78	1·32	22	6	0	15	24	..	..	2	2	22	18	8	3
July	·822	83·1	86·0	81·7	76·9	88·7	74·0	92·5	·812	·841	·827	71	79	75	5·4	5·4	5·4	3·40	0·96	19	6	0	11	12	..	..	..	1	20	21	14	2
August .	·799	83·0	87·1	82·1	77·1	89·9	74·0	93·0	·824	·850	·837	72	80	76	5·7	5·2	5·4	3·07	0·60	24	7	2	11	21	..	1	..	3	16	17	21	3
September	·798	81·3	84·8	80·6	76·4	87·7	74·0	92·0	·834	·855	·844	78	84	81	6·0	5·9	5·9	12·46	2·00	25	12	0	15	15	5	1	..	1	19	18	10	4
October ..	·880	82·4	84·6	81·0	76·8	88·6	74·5	93·0	·883	·893	·888	80	87	83	5·4	5·0	5·2	7·07	1·36	21	5	1	7	17	12	7	7	3	19	5	3	5
November	·957	78·9	83·6	78·3	73·4	85·9	63·0	88·5	·764	·792	·778	76	83	79	4·8	3·0	3·9	5·37	1·55	10	4	7	4	4	23	8	9	2	2	2	3	1
December	29·996	75·5	82·7	75·5	69·0	84·3	64·5	90·0	·636	·681	·658	71	78	74	1·6	1·2	1·4	0.04	0·04	1	2	15	0	0	44	7	5	2	1	..	..	..
Year ..	29·885	81·4	86·3	80·6	74·9	88·3	59·0	96·5	·792	·822	·807	72	80	76	4·4	3·8	4·1	46·86	2·00	151	70	49	84	136	90	33	31	30	249	126	69	24
1866.																																
	In.	°	°	°	°	°	°	°	In.	In.	In.							In.	In.													
January	29·997	78·1	85·6	77·4	69·4	87·7	65·5	93·0	·699	·718	·709	72	78	75	1·8	1·0	1·4	..	..	2	0	16	0	0	24	12	13	1	1	1	..	..
February	·909	80·3	86·6	80·1	74·1	88·6	68·5	92·0	·823	·810	·816	80	80	80	4·0	1·7	2·8	3·28	1·65	7	2	4	2	1	4	3	12	2	24	4	..	1
March ..	·885	82·9	90·6	82·4	74·5	93·0	70·0	95·5	·771	·809	·790	68	74	71	3·0	1·3	2·1	..	..	1	1	6	0	1	1	1	1	..	41	9	7	1
April	·844	85·5	91·7	85·0	79·0	94·1	73·8	97·0	·861	·877	·869	69	75	72	5·0	3·0	4·0	1·10	0·30	10	7	0	5	10	2	..	3	7	37	3	2	1
May	·782	83·0	85·8	81·6	76·8	89·7	72·5	97·0	·845	·870	·858	75	82	78	6·0	5·9	5·9	17·66	3·45	20	14	0	15	22	3	..	7	1	33	9	5	1
June	·794	83·9	86·0	82·4	78·1	89·4	75·0	93·0	·831	·893	·862	71	83	77	5·8	6·1	5·9	4·10	1·30	16	8	0	7	4	..	..	..	..	47	6	3	..
July	·809	81·4	84·0	80·2	76·2	88·1	73·0	96·0	·841	·857	·849	78	86	82	5·5	7·0	6·2	13·68	3·35	26	11	0	15	9	..	..	..	1	34	10	16	1
August ..	·816	81·3	85·2	81·1	76·2	89·0	74·0	92·0	·821	·839	·830	77	81	79	5·3	5·8	5·5	9·45	1·80	17	8	0	13	14	1	..	3	1	22	18	15	2
September	·803	81·9	85·6	80·8	76·7	88·6	75·0	92·0	·841	·850	·845	78	85	81	6·0	7·5	6·7	11·50	1·80	22	10	1	12	11	5	..	..	1	30	2	11	5
October ..	·893	80·7	85·3	80·1	75·1	87·3	69·0	91·0	·838	·839	·838	79	84	81	4·7	4·4	4·6	5·48	1·08	14	9	4	4	14	34	2	16	..	4	..	1	..
November	29·974	75·9	81·9	75·9	70·3	83·7	63·5	90·0	·662	·737	·700	73	82	78	3·2	2·9	3·0	0·29	0·25	6	1	7	3	6	44	6	8	..	..	..	..	
December	30·047	70·1	78·2	70·7	63·3	81·6	57·0	86·0	·523	·566	·544	69	74	72	3·0	2·0	2·5	..	..	2	0	11	2	0	50	1	1	..	1	.	..	1
Year ..	29·879	80·4	85·5	79·8	74·1	88·4	57·0	97·0	·779	·805	·792	74	80	77	4·4	4·0	4·2	66·54	3·45	143	71	49	78	92	168	25	64	14	274	62	60	13

Months.	Mean Pressure.								Vapour.			Humidity.			Cloud.			Rainfall.		days of					Wind, No. of Observations of							
		9 a.m.	4 p.m.	Mean.	Means of		Absolute		9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.	Total.	Max.	Rain.	Thunder Storm.	Clear Sky.	Overcast.	Lightning.	N.	NE.	E	SE.	S.	SW.	W.	NW.
					Min.	Max.	Min.	Max.																								
	In.	°	°	°	°	°	°	°	In.	In.	In.							In.	In.													
January	30·022	73·4	84·1	74·1	65·3	85·8	61·0	90·0	·600	·638	·619	79	76	77	3·2	1·8	2·5	..	..	0	0	7	3	0	15	10	28	..	7	1	..	1
February	29·925	78·6	87·6	79·4	72·2	89·3	68·0	91·0	·752	·788	·770	77	79	78	5·4	1·8	3·6	..	..	2	1	1	4	0	6	6	8	2	25	3	..	..
March ..	·924	83·7	89·0	82·5	75·6	91·6	72·0	95·0	·797	·845	·821	68	78	73	3·6	2·2	2·9	0·41	0·30	2	2	3	2	4	..	..	2	3	51	3	..	..
April	·875	83·6	91·0	83·4	76·4	92·9	73·0	96·5	·849	·854	·851	73	76	74	5·8	4·0	4·9	0·75	0·75	7	9	1	7	15	3	2	3	4	35	4	3	
May	·776	85·2	90·3	83·8	77·5	94·1	74·0	97·5	·852	·860	·856	70	77	73	5·6	4·4	5·0	4·12	1·44	17	14	3	11	20	3	..	4	1	33	12	4	1
June ..	·777	83·3	87·1	82·0	76·5	89·1	73·5	95·0	·825	·867	·846	72	81	76	6·0	5·8	5·9	6·92	1·98	21	7	0	11	17	..	1	1	1	19	24	14	..
July	·803	82·5	86·4	81·4	76·5	89·9	74·0	94·0	·842	·865	·853	76	85	80	6·2	6·2	6·2	11·79	1·92	19	14	0	12	14	2	2	..	3	14	35	3	1
August ..	·797	82·2	86·4	81·6	76·2	89·3	71·5	93·5	·843	·874	·858	77	85	81	5·6	6·3	5·9	5·49	1·35	21	8	0	10	15	1	1	1	5	27	14	13	..
September	·790	81·6	83·8	80·1	76·3	87·4	72·5	90·0	·853	873	·863	80	88	84	6·8	7·2	7·0	10·88	2·00	24	8	0	16	13	3	1	1	3	25	14	11	..
October ..	29·894	81·7	84·9	80·4	75·9	86·3	73·5	91·0	·839	·870	·854	77	87	82	5·0	5·0	5·0	9·04	1·66	19	9	3	10	9	26	4	8	5	1	10	4	3
November	30·042	76·2	81·6	75·2	69·0	83·8	59·8	88·5	·675	·681	·678	73	79	76	2·9	1·6	2 2	0·81	0·40	6	1	10	1	8	38	9	12	..	..	..	1	..
December	30·024	72·6	80·7	72·4	64·4	82·7	60·0	86·5	·557	·608	·582	69	77	73	2·6	2·8	2·7	..	..	2	0	7	2	0	26	19	14	1	..	..	..	..
Year .	29·887	80·4	86·0	79·7	73·5	88·5	59·8	97·5	·772	·802	·787	74	80	77	4·9	4·1	4·5	50·21	2·00	140	73	35	89	115	123	55	82	28	237	120	53	6
1868.																																
	In.	°	°	°	°	°	°	°	In.	In.	In.							In.	In.													
January	29·956	76·0	85·9	76·6	68·7	88·0	59·0	92·0	·698	·728	·713	77	80	78	4·0	1·6	2·8	..	..	0	0	3	3	3	10	6	24	..	20	..	..	1
February	·925	80·9	87·4	80·0	72·3	89·4	69·0	92·0	·809	·813	·811	77	80	78	3·8	2·7	3·2	.0 04	0·03	2	0	2	0	1	..	..	8	4	32	9	..	..
March ..	·898	84·7	89·3	83·2	76·4	92·0	72 0	96·0	839	·854	·846	70	77	73	4·7	2·3	3·5	0·53	0·53	4	2	0	0	16	1	..	1	3	47	7	..	
April	·874	84·0	89·7	83·3	76·4	93·3	71·0	97·0	·821	·874	·847	71	76	73	..	..	..	7·08	2·05	6	4	..	..	1	..	..	..	1	43	1	15	..
May	·872	81·8	85·4	81·1	76·1	89·9	73·0	95·0	·909	·923	·916	84	88	86	..	..	..	15·11	3·90	11	4	..	..	0	2	..		..	30	8	22	..
June	·824	83·3	87·3	82·4	77·4	90·4	74·0	94·0	·855	·875	·865	75	80	78	:	..	..	10·82	1·50	15	1	..	..	1	..	..	..	..	7	20	29	..
July	·815	82·9	86·8	81·6	76·1	90·0	72·0	95·0	·831	·873	·852	74	83	78	..	..	..	7·35	3·10	17	3	..	..	..	2	..	..	1	10	42	7	..
August ..	·799	82·3	84·9	80·4	77·3	89·4	75·0	94·0	·873	·901	·887	79	85	82	..	..	..	3·98	0·65	14	6	..	..	..	1	.	..	..	15	40	5	..
September	·826	81·4	84·6	80·2	76·0	89·0	73·0	93·0	·830	·854	·842	77	84	80	..	..	..	16·53	3·91	17	5	...	..	..	9	..	2	3	11	7	27	..
October ..	·894	80·3	85·2	80·2	75·7	89·2	72·0	93·0	·886	·891	·888	85	88	86	..	..	..	9·19	1·50	7	7	..	..	..	24	6	8	..	10	3	6	4
November	29·976	76·5	83·4	77·1	71·5	86·5	63·0	93·0	·751	·781	·766	81	83	82	..	..	..	2 14	0·98	5	2	..	..	..	35	6	4	2	4	..	..	..
December	30·004	76·2	83·6	76·1	69·0	86·5	65·0	91·0	·680	·703	·691	75	79	77	..	..	..	..	..	..	..	..	..	..	21	40	1	..	..	..	..	..
Year ..	29·888	80·8	86·1	80·1	74·4	89·4	59·0	97·0	·815	·839	·827	77	82	79	..	..	..	72·77	3·91	98	34	..	..	...	105	58	48	14	229	137	111	5

AVERAGE MONTHLY RESULTS FOR THE 10 YEARS.

Months.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Year.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Mean Pressure	29·950	29·906	29·870	29·822	29·777	29·751	29·769	29·767	29·774	29·847	29·943	29·971	29·845
	°	°	°	°	°	°	°	°	°	°	°	°	°
Mean Temperature	76·1	79·1	82·5	83·4	82·3	82·3	81·4	81·4	80·3	80·1	76·8	74·8	80·1
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Tension of Vapour	·679	·780	·833	·859	·870	·870	·853	·854	·854	·852	·720	·647	·806
Relative Humidity	75	78	74	75	78	78	78	79	82	82	77	74	77
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Rainfall	0·09	0·56	0·83	2·42	10·54	7·72	8·02	5·65	11·30	7·46	2·36	0·09	67·04
Wind N	132	34	9	19	29	2	7	4	26	133	316	318	1029
NNE	86	22	4	14	7	..	..	2	14	90	125	68	432
NE	79	48	27	20	11	4	2	6	20	71	93	152	433
ENE	34	8	13	9	1	1	..	1	5	10	17	13	112
E	88	43	19	23	14	4	6	8	11	68	52	45	381
ESE	28	14	19	10	8	3	..	2	4	27	12	11	138
SE	17	33	23	32	18	9	22	16	22	34	17	7	250
SSE	22	53	83	104	88	25	29	26	28	17	15	8	498
S	51	149	258	165	157	147	130	98	78	40	4	10	1287
SSW	49	97	249	243	174	144	125	121	141	39	3	1	1386
SW	20	71	85	86	142	311	367	310	175	81	7	2	1657
WSW	4	4	9	19	33	25	34	65	47	11	4	..	255
W	5	5	8	36	49	95	54	77	77	53	8	5	472
WNW	2	1	3	5	7	10	22	27	27	13	5	1	123
NW	7	4	3	14	15	8	14	12	23	35	12	13	160
WNW	28	6	1	6	14	1	3	4	18	29	59	64	233

upon the height of the mercurial column or its daily tides, which take place about 8¼ a.m. and p.m. for minima, and 9¼ a.m. and p.m. for maxima. The range is about 0·110 in., but occasionally it amounts to 0·180 in.

Temperature.—The lowest temperature of the year occurs in December, though sometimes it may be in November, January or February, and the highest usually takes place in April, but it may be noticed in the preceding or subsequent month. In this record the minimum, 57°, took place in December, and the maximum, 97°·5, in May. The monthly means make the extremes in December and April. The *Tension of Vapour* follows a similar rule, viz. the lowest in December and highest in May, but the tables of *Humidity* and *Rainfall* are different; these agree in making December the minimum and September the maximum of the year. The years 1859 and 1864 were remarkable for little rain, years of drought, in 1865 rice was imported, whilst 1860 and 1868 were the years of greatest rainfall.

Hail occurred only once, one afternoon, during my residence of fifteen years.

Winds.—In September the SW monsoon becomes weak; early in October N breezes set in, varying from W to E by the northern segment, and during this month or November the NE monsoon is quite established. Throughout December it continues strong, but in January it has lost half of its last month's vigour, and in February retains only a fifth of its original force; the deficiency being in part made up by an increase of wind varying from SSE to SW. By the end of the month or early in March the N winds have ceased and strong breezes from S and SSW prevail, locally termed the Kite and Junk winds. It is in April that the greatest heat takes place, and for two or three nights in succession, if no breeze stirs the air, the plight of foreigners, ay even of natives, is not to be envied. During the months of May, June, July and August, the SW winds are strong and constant, sometimes boisterous, the direction being chiefly S and SSW till June, and thence SW to September, when light variable winds are the rule, and foretell a breaking up of the SW monsoon.

PROCEEDINGS AT THE MEETINGS OF THE SOCIETY.

NOVEMBER 20th, 1878.

Ordinary Meeting.

CHARLES GREAVES, M.Inst.C.E., F.G.S., President, in the Chair.

Rev. THOMAS LEO ALMOND, O.S.B., St. Gregory's College, Downside, Bath;
Rev. THOMAS CALVERT BEASLEY, M.A., Dallington, Northamptonshire;
FRANCIS THOMAS BIRCHAM, Burhill, Hersham, Walton-on-Thames;
HENRY F. BLANFORD, F.G.S., Meteorological Office, Calcutta;
GEORGE CHATTERTON, B.A., 46 Queen Anne's Gate, S.W.;
EDWARD EASTON, M.Inst.C.E., F.G.S., 9 Delahay Street, S.W.;
WILSON LLOYD FOX, Falmouth;
GEORGE FOSBERY LYSTER, M.Inst.C.E., Dock Yard, Liverpool;

1865.

Months.	Mean Pressure.	Air Temperature.							Tension of Vapour.			Relative Humidity.			Amount of Cloud.			Rainfall.		Weather, No. of days of					Wind, No. of Observations of							
					Means of		Absolute																									
		9½ a.m.	3½ p.m.	Mean.	Min.	Max.	Min.	Max.	9½ a.m.	9½ p.m.	Mean.	9½ a.m.	9½ p.m.	Mean.	9½ a.m.	9½ p.m.	Mean.	Total.	Max.	Rain.	Thunder Storm.	Clear Sky.	Overcast.	Lightning.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
	In.	°	°	°	°	°	°	°	In.	In.	In.							In.	In.													
January	30·048	74·6	84·6	74·1	64·3	83·9	59·0	87·0	·561	·628	·594	65	75	70	1·0	0·4	0·7	0·06	0·06	1	..	9	0	0	1	8	4	2	2	2	..	..
February	29·931	81·2	86·9	80·1	72·7	87·8	67·0	91·0	·780	·801	·790	73	79	76	3·0	2·0	2·5	..	..	3	..	9	2	0	..	..	1	5	38	11	1	..
March ..	·911	84·9	89·8	84·0	78·7	91·3	73·5	96·0	·826	·854	·840	68	76	72	3·8	3·5	3·6	..	..	1	1	3	3	10	..	1	1	4	45	9	..	..
April	·860	85·7	91·0	85·1	79·7	92·4	74·0	94·0	·878	·908	·893	71	78	74	4·5	3·6	4·0	0·75	0·75	5	7	2	2	14	2	..	..	2	41	13	..	2
May	·835	83·4	87·9	82·2	76·3	90·6	73·0	96·5	·843	·876	·860	73	82	77	5·2	6·0	5·6	8·86	1·50	19	20	1	14	19	3	..	2	3	24	10	9	4
June	·788	83·8	86·9	82·7	78·2	89·3	74·5	94·0	·869	·886	·877	75	81	78	6·5	5·3	5·9	5·78	1·32	22	6	0	15	24	..	..	2	2	22	18	8	3
July	·822	83·1	86·0	81·7	76·9	88·7	74·0	92·5	·812	·841	·827	71	79	75	5·4	5·4	5·4	3·40	0·96	19	6	0	11	12	..	..	..	1	20	21	14	2
August .	·799	83·0	87·1	82·1	77·1	89·9	74·0	93·0	·824	·850	·837	72	80	76	5·7	5·2	5·4	3·07	0·60	24	7	2	11	21	..	1	..	3	16	17	21	3
September	·798	81·3	84·8	80·6	76·4	87·7	74·0	92·0	·834	·855	·844	78	84	81	6·0	5·9	5·9	12·46	2·00	25	12	0	15	15	5	1	..	1	19	18	10	4
October ..	·880	82·4	84·6	81·0	76·8	88·6	74·5	93·0	·883	·893	·888	80	87	83	5·4	5·0	5·2	7·07	1·36	21	5	1	7	17	12	7	7	3	19	5	3	5
November	·957	78·9	83·6	78·3	73·4	85·9	63·0	88·5	·764	·792	·778	76	83	79	4·8	3·0	3·9	5·37	1·55	10	4	7	4	4	23	8	9	2	2	2	3	1
December	29·996	75·5	82·7	75·5	69·0	84·3	64·5	90·0	·636	·681	·658	71	78	74	1·6	1·2	1·4	0.04	0·04	1	2	15	0	0	44	7	5	2	1	..	..	..
Year ..	29·885	81·4	86·3	80·6	74·9	88·3	59·0	96·5	·792	·822	·807	72	80	76	4·4	3·8	4·1	46·86	2·00	151	70	49	84	136	90	33	31	30	249	126	69	24
1866.																																
	In.	°	°	°	°	°	°	°	In.	In.	In.							In.	In.													
January	29·997	78·1	85·6	77·4	69·4	87·7	65·5	93·0	·699	·718	·709	72	78	75	1·8	1·0	1·4	..	..	2	0	16	0	0	24	12	13	1	1	1	..	..
February	·909	80·3	86·6	80·1	74·1	88·6	68·5	92·0	·823	·810	·816	80	80	80	4·0	1·7	2·8	3·28	1·65	7	2	4	2	1	4	3	12	2	24	4	..	1
March ..	·885	82·9	90·6	82·4	74·5	93·0	70·0	95·5	·771	·809	·790	68	74	71	3·0	1·3	2·1	..	..	1	1	6	0	1	1	1	1	..	41	9	7	1
April	·844	85·5	91·7	85·0	79·0	94·1	73·8	97·0	·861	·877	·869	69	75	72	5·0	3·0	4·0	1·10	0·30	10	7	0	5	10	2	..	3	7	37	3	2	1
May	·782	83·0	85·8	81·6	76·8	89·7	72·5	97·0	·845	·870	·858	75	82	78	6·0	5·9	5·9	17·66	3·45	20	14	0	15	22	3	..	7	1	33	9	5	1
June	·794	83·9	86·0	82·4	78·1	89·4	75·0	93·0	·831	·893	·862	71	83	77	5·8	6·1	5·9	4·10	1·30	16	8	0	7	4	..	..	..	..	47	6	3	..
July	·809	81·4	84·0	80·2	76·2	88·1	73·0	96·0	·841	·857	·849	78	86	82	5·5	7·0	6·2	13·68	3·35	26	11	0	15	9	..	..	..	1	34	10	16	1
August ..	·816	81·3	85·2	81·1	76·2	89·0	74·0	92·0	·821	·839	·830	77	81	79	5·3	5·8	5·5	9·45	1·80	17	8	0	13	14	1	..	3	1	22	18	15	2
September	·803	81·9	85·6	80·8	76·7	88·6	75·0	92·0	·841	·850	·845	78	85	81	6·0	7·5	6·7	11·50	1·80	22	10	1	12	11	5	..	..	1	30	2	11	5
October ..	·893	80·7	85·3	80·1	75·1	87·3	69·0	91·0	·838	·839	·838	79	84	81	4·7	4·4	4·6	5·48	1·08	14	9	4	4	14	34	2	16	..	4	..	1	..
November	29·974	75·9	81·9	75·9	70·3	83·7	63·5	90·0	·662	·737	·700	73	82	78	3·2	2·9	3·0	0·29	0·25	6	1	7	3	6	44	6	8	..	..	..	..	
December	30·047	70·1	78·2	70·7	63·3	81·6	57·0	86·0	·523	·566	·544	69	74	72	3·0	2·0	2·5	..	..	2	0	11	2	0	50	1	1	..	1	.	..	1
Year ..	29·879	80·4	85·5	79·8	74·1	88·4	57·0	97·0	·779	·805	·792	74	80	77	4·4	4·0	4·2	66·54	3·45	143	71	49	78	92	168	25	64	14	274	62	60	13

Months.	Pressure.	9 a.m.	4 p.m.	Mean.	Means of		Absolute		9 a.m.	9 p.m.	Mean.	9 a.m	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.	Total.	Max.	Rain.	Thunder Storm.	Clear Sky.	Overcast.	Lightning.	N.	NE.	E	SE.	S.	SW.	W.	NW.
					Min.	Max.	Min.	Max.																								
	In.	°	°	°	°	°	°	°	In.	In.	In.							In.	In.													
January	30·022	73·4	84·1	74·1	65·3	85·8	61·0	90·0	·600	·638	·619	79	76	77	3·2	1·8	2·5	..	..	0	0	7	3	0	15	10	28	..	7	1	..	1
February	29·925	78·6	87·6	79·4	72·2	89·3	68·0	91·0	·752	·788	·770	77	79	78	5·4	1·8	3·6	..	..	2	1	1	4	0	6	6	8	2	25	3	..	..
March ..	·924	83·7	89·0	82·5	75·6	91·6	72·0	95·0	·797	·845	·821	68	78	73	3·6	2·2	2·9	0·41	0·30	2	2	3	2	4	..	..	2	3	51	3	..	..
April	·875	83·6	91·0	83·4	76·4	92·9	73·0	96·5	·849	·854	·851	73	76	74	5·8	4·0	4·9	0·75	0·75	7	9	1	7	15	3	2	3	4	35	4	3	
May	·776	85·2	90·3	83·8	77·5	94·1	74·0	97·5	·852	·860	·856	70	77	73	5·6	4·4	5·0	4·12	1·44	17	14	3	11	20	3	..	4	1	33	12	4	1
June ..	·777	83·3	87·1	82·0	76·5	89·1	73·5	95·0	·825	·867	·846	72	81	76	6·0	5·8	5·9	6·92	1·98	21	7	0	11	17	..	1	1	1	19	24	14	..
July	·803	82·5	86·4	81·4	76·5	89·9	74·0	94·0	·842	·865	·853	76	85	80	6·2	6·2	6·2	11·79	1·92	19	14	0	12	14	2	2	..	3	14	35	3	1
August ..	·797	82·2	86·4	81·6	76·2	89·3	71·5	93·5	·843	·874	·858	77	85	81	5·6	6·3	5·9	5·49	1·35	21	8	0	10	15	1	1	1	5	27	14	13	..
September	·790	81·6	83·8	80·1	76·3	87·4	72·5	90·0	·853	873	·863	80	88	84	6·8	7·2	7·0	10·88	2·00	24	8	0	16	13	3	1	1	3	25	14	11	..
October ..	29·894	81·7	84·9	80·4	75·9	86·3	73·5	91·0	·839	·870	·854	77	87	82	5·0	5·0	5·0	9·04	1·66	19	9	3	10	9	26	4	8	5	1	10	4	3
November	30·042	76·2	81·6	75·2	69·0	83·8	59·8	88·5	·675	·681	·678	73	79	76	2·9	1·6	2 2	0·81	0·40	6	1	10	1	8	38	9	12	..	..	..	1	..
December	30·024	72·6	80·7	72·4	64·4	82·7	60·0	86·5	·557	·608	·582	69	77	73	2·6	2·8	2·7	..	..	2	0	7	2	0	26	19	14	1	..	..	..	..
Year .	29·887	80·4	86·0	79·7	73·5	88·5	59·8	97·5	·772	·802	·787	74	80	77	4·9	4·1	4·5	50·21	2·00	140	73	35	89	115	123	55	82	28	237	120	53	6

1868.

Months.	Pressure.	9 a.m.	4 p.m.	Mean.	Means of		Absolute		9 a.m.	9 p.m.	Mean.	9 a.m	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.	Total.	Max.	Rain.	Thunder Storm.	Clear Sky.	Overcast.	Lightning.	N.	NE.	E	SE.	S.	SW.	W.	NW.
					Min.	Max.	Min.	Max.																								
	In.	°	°	°	°	°	°	°	In.	In.	In.							In.	In.													
January	29·956	76·0	85·9	76·6	68·7	88·0	59·0	92·0	·698	·728	·713	77	80	78	4·0	1·6	2·8	..	..	0	0	3	3	3	10	6	24	..	20	..	..	1
February	·925	80·9	87·4	80·0	72·3	89·4	69·0	92·0	·809	·813	·811	77	80	78	3·8	2·7	3·2	·0 04	0·03	2	0	2	0	1	..	..	8	4	32	9	..	..
March ..	·898	84·7	89·3	83·2	76·4	92·0	72 0	96·0	839	·854	·846	70	77	73	4·7	2·3	3·5	0·53	0·53	4	2	0	0	16	1	..	1	3	47	7	..	
April	·874	84·0	89·7	83·3	76·4	93·3	71·0	97·0	·821	·874	·847	71	76	73	..	..	..	7·08	2·05	6	4	..	..	1	..	..	..	1	43	1	15	..
May	·872	81·8	85·4	81·1	76·1	89·9	73·0	95·0	·909	·923	·916	84	88	86	..	..	..	15·11	3·90	11	4	.	..	0	2	..		..	30	8	22	..
June	·824	83·3	87·3	82·4	77·4	90·4	74·0	94·0	·855	·875	·865	75	80	78	:	..	..	10·82	1·50	15	1	..	..	1	..	..	..	..	7	20	29	..
July	·815	82·9	86·8	81·6	76·1	90·0	72·0	95·0	·831	·873	·852	74	83	78	..	..	..	7·35	3·10	17	3	..	..	..	2	..	..	1	10	42	7	..
August ..	·799	82·3	84·9	80·4	77·3	89·4	75·0	94·0	·873	·901	·887	79	85	82	..	..	..	3·98	0·65	14	6	..	..	..	1		..	..	15	40	5	..
September	·826	81·4	84·6	80·2	76·0	89·0	73·0	93·0	·830	·854	·842	77	84	80	..	..	..	16·53	3·91	17	5	...	..	..	9	..	2	3	11	7	27	..
October ..	·894	80·3	85·2	80·2	75·7	89·2	72·0	93·0	·886	·891	·888	85	88	86	..	..	..	9·19	1·50	7	7	..	..	..	24	6	8	..	10	3	6	4
November	29·976	76·5	83·4	77·1	71·5	86·5	63·0	93·0	·751	·781	·766	81	83	82	..	..	..	2 14	0·98	5	2	..	..	..	35	6	4	2	4	..	..	..
December	30·004	76·2	83·6	76·1	69·0	86·5	65·0	91·0	·680	·703	·691	75	79	77	..	..	..	..	..	..	..	..	..	..	21	40	1	..	..	..	..	..
Year ..	29·888	80·8	86·1	80·1	74·4	89·4	59·0	97·0	·815	·839	·827	77	82	79	..	..	..	72·77	3·91	98	34	..	..	...	105	58	48	14	229	137	111	5

Before proceeding with a description of the instruments at Colába, Mr. Chambers remarks (page 8) :—

"The treatment that we propose to apply to the observations of each meteorological element in succession is, first, to find the most probable absolute value of the element ; secondly, to examine whether it is subject to any secular change which the observations are precise enough to exhibit ; thirdly, to determine its periodical variations ; fourthly, to determine its variability, and its range of variation, and the limits thereof, at different seasons ; and, lastly, to exhibit all the results arrived at, as concisely as possible, by means of suitable diagrams. The elements that will be thus treated are, barometric pressure, temperature of the air, pressure of vapour, temperature of the ground, rainfall, and direction and velocity of the wind ; and observations of other phenomena, of less definiteness of character than these, or such as require less attention, will be treated in a less elaborate manner."

He further considers (page 8) that "as a means of concise representation of phenomena of observational science, graphical constructions are greatly superior to verbal descriptions ; for by means of them, the eye can take in, at one view, a body of facts which it would require a considerable effort of memory to retain and consider by a single mental operation, after verbal communication of them ; . . . we regard it therefore as conducing to economy of mental effort to make a free use of graphical constructions."

The same barometer at Colába was used throughout, Newman No. 58 ; the internal diameter of its tube being 0·530 in. There is a suspicion (page 9) that the absolute pressures observed with it may not be quite the true pressures, but that "they must be regarded as subject to correction when an authentic standard becomes available for comparison with Newman No. 58."

Table I. gives the mean monthly values of barometer for Colába corrected for temperature, but not reduced to sea level, for each month, for the years 1847 to 1872 ; and Table II. the mean value for each day of the year, as deduced from the observations for the twenty-four years ending 1870. In a table of the latter kind it becomes necessary to exclude by some means the influence of variations of accidental character. Mr. Chambers remarks that the usual method of effecting this is to apply what is commonly know as Bessel's process for finding an expression for a periodical phenomenon, which assumes that the law of variation may be expressed by the superposition of a series of simple variations whose periods are once, a half, a third, a fourth, &c. of that of the observed phenomenon.[*] But he finds, as will frequently be the case, that although diurnal variations may generally be closely represented in this way, annual variations cannot be so satisfactorily represented. He shows graphically the barometer curve for the year, as observed, and also that given by dividing the year into seventy-three equal groups, and applying Bessel's formula carried to six terms, but the latter does not sufficiently completely represent the observed curve. He adds a curve, found by an arbitrary process, which he considers is to be preferred. His process is to take means of successive pairs of the observed values, forming (according to the method employed by the Astronomer Royal in dealing with the Earth Current records) smoothed means. He does this six times. Finally he takes the mean of the first fifteen (six times smoothed) values in January, and considers this to be the normal value for January 8 : the mean of the fifteen values January 2-16 he considers to be the normal value for January 9, and so on. In other cases of annual variation, afterwards treated, Mr. Chambers constantly uses this same method, in preference to Bessel's formula, although he adopts the latter for diurnal and other variations.

In Table VI. is given the mean diurnal variation of the barometer in each month of the year. In each month Mr. Chambers has applied Bessel's formula carried to four terms. It is interesting to note how the several coefficients and angles vary in the different months, arriving severally at their epochs of maxima and minima at different parts of the year. Mr. Chambers shows the diurnal variations also by graphical construction : indeed diagrams have been throughout provided in a lavish manner with the view of conveying better to the eye

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[*] An expression of the form

$$x = m + a.\ \sin\,(\theta + \mathrm{A}) + b.\ \sin\,(2\theta + \mathrm{B}) + \&c.$$

in which m, a, A. b, B, &c., are constants.

the character of the changes of the various elements. Tables follow giving the extreme single readings, and the extreme daily and monthly means in each year from 1847 to 1872, and also the extreme single readings and daily means in each of the twelve months of the year. These extremes are also all graphically represented. He deduces the comparative frequency and probability of occurrence of pressures within certain limits in each half month of the year, and discusses the relative magnitude of "abnormals," or deviations of mean daily pressure from the normal pressure, in each half month of the year.

Before giving any results in regard to temperature, Mr. Chambers discusses the question of thermometer exposure, and also, at some length, the influence of radiation. In the last adopted form of exposure the thermometers are mounted on light wooden rods, inside an open cage, with venetian sides and depressed venetian bottom; the cage being supported by four corner posts, which enter the ground, leaving its open bottom at a height of 3 feet, and the bulbs of the thermometers 4½ feet from the soil; the cage is 3 feet square, and 5 feet high, with closed roof; and it is placed under the middle of an open shed.

Tables follow in regard to temperature analogous to those described for barometric pressure: the whole treatment is generally similar to that in the barometric section.

The pressure of vapour is found from the readings of the dry and wet bulb thermometers by Apjohn's formula, and tables referring to pressure of vapour are given much in the same way as for the other elements. These results are discussed at some length, and also in connection with prevalent winds.

There follows some results in regard to the amount of cloudy sky, after which the thermometers for indicating earth temperatures are described. Of these there are several, the bulbs of the two that are deepest being respectively 5 feet and 12 feet below the surface. The 12-foot thermometer after a few years' observations was accidentally broken in the hurricane of November 1-2, 1854, and has not since been replaced. The mean annual variations of the 9-inch, 20-inch, 5-foot and 12-foot thermometers have been treated by the process used by Professor J. D. Everett in dealing with similar results obtained from observations made at Greenwich Observatory. Mr. Chambers finds for the value of the thermal co-efficient for Bombay, referred to the English foot, 0·1149, or 0·1225, as referred to the French foot. Unavoidably the series of observations of the different thermometers does not extend over quite the same years, but the result is probably not essentially altered by this circumstance. The corresponding numbers found at other places, as referred to the French foot, are:—

At Edinburgh, Calton Hill	Trap Rock	0·1156
„ Experimental Garden	Sand	0·1098
„ Craigleith Quarry	Sandstone	0·0674
At Greenwich, Royal Observatory	Gravel and sand.	0·092.

Mr. Chambers comes now to the important question of rainfall. He gives the rainfall in each month for 32 years, and points out that the results somewhat confirm the supposed connection between rainfall and sun-spots pointed out by Mr. Meldrum. He gives also the average rainfall for each day, the greatest and least amounts collected in one hour, one day, and one month, in different years, the proportion at different hours of the day, and the comparative frequency of falls of definite magnitude in each half month of the year, with some remarks on the variation in the amount of rainfall with altitude. This appears to be least with heavy rains, that is, at such times the falls are more nearly equal.[*]

The anemometer was a Robinson anemometer with improvements by Mr. Beckley. The centres of each pair of opposite hemispherical cups are 4 feet apart, and the diameter of the cups is 9 inches. Movement and direction of the wind are registered on the same sheet. Tabulations of movement and direction have been made for two-hourly periods during seven years. The movements have been resolved into northerly and easterly components, mean values of which are given for every month of observation: mean values are also given for every day of the year, and for each hour of the day in different months. The diurnal variations for each month thence obtained are treated by Bessel's formula. (The normal daily values are 29 day means of six times smoothed values, instead of 15 day means, as in the case of other elements.)

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[*] The same thing has been remarked at the Royal Observatory at Greenwich. The amount collected at an elevation more nearly equals that collected on the ground when the rain is heavy, although there is another circumstance to be remembered, which is that at such times the air is usually more nearly calm.

There then follows a general comparison of the diurnal variations of different phenomena. Instead of taking the constants found by the application of Bessel's formula, and given in preceding parts of the work, Mr. Chambers here employs the equivalent formula—

$$4\ X = a_1 \cos \theta + b_1 \sin \theta + a_2 \cos 2\theta + b_2 \sin 2\theta + \&c.$$

and exhibits in tables the co-efficients a_1, b_1, a_2, b_2, &c., for each month of the year, for the north component of wind, east component of wind, temperature of the air, and barometric pressure. He compares together the graphical projections of the co-efficients of corresponding pairs of terms in the expressions for the diurnal inequalities of the different elements, and indicates points of resemblance and difference. Remarking then that the variations of the co-efficients of the different phenomena are related to the annual amplitude lines of the several curves in such a way that, if these be twisted so as to coincide in direction, the curves are nearly similarly situated, he transforms the co-efficients into other equivalent ones, to exhibit in a stronger light the similarities and differences pointed out. It is remarked that some of the relations are satisfactorily explained by the common theory of land and sea breezes. This completes Part I. of the work.

Part II. treats of the observations on a less extended scale made at the military stations Belgaum, Poona, Deesa, and Kurrachee, including the corresponding observations at Bombay, specially made for comparison with this series. The various results are tabulated and discussed much in the same spirit as the more extended Bombay observations, treated in Part I. It is scarcely necessary to refer to these in any detail.

In Part III. Mr. Chambers has collected a number of results of observations on temperature, wind, and rainfall made at many different places in the Presidency, and has constructed charts to show the variations in these elements with locality. Temperature and wind charts are given for each month of the year, and separate monthly rain charts from May to November, including the whole of the rainy season. To these are added one large chart showing the annual rainfall over the whole district treated, and another indicating the positions of the stations at which any observations that have been used were made. The rain charts appear to give important information on the very unequal distribution of rain in the district, and copious notes on the subject are to be found also in the text.

Part IV. treats of "the climate of the Presidency, and its variations under change of physical conditions and with change of season." Mr. Chambers remarks that in the three preceding parts of the work the principle of aiming mainly and immediately at the establishment of phenomenal laws has been fairly kept in view. Here he proceeds to connect together some of the general phenomenal results arrived at. After giving certain topographical information necessary for a proper understanding of the contour of the country, Mr. Chambers explains his notions on aërial circulation; investigates the law of variation of temperature with pressure; and states the consequences that he should expect to be observable in the earth's atmosphere in the part of it overlying India. Referring then to the theoretical relations of various phenomena, he proceeds to discuss at some length the distribution and variation of temperature, remarking here how misleading must be corrections of observed temperatures to mean sea level based on the assumption of a uniform rate of decrease with height. The distribution and variation of rainfall and subjects related thereto are then spoken of. Attention is also called to the problem of the determination of heights by means of observations of barometric pressure, and especially to advantages that seem to attach to the treatment of the question as a dynamical rather than a statical one, both as securing greater accuracy in the practical result and as suggesting truer conceptions of the physical conditions involved. This necessarily brief and imperfect account of Part IV. makes no attempt to describe in detail the various interesting theoretical discussions and their application to observed phenomena, introduced by Mr. Chambers in this portion of his work; but what has been stated will give some indication of the nature of its contents, which can hardly be more distinctly set forth without going into greater explanation and occupying more space than would perhaps here serve any very useful purpose.

In conclusion it may be mentioned that it has been more the object of this abstract to indicate generally the manner in which the various subjects have been treated than to give any of the actual results arrived at. The reader who may desire a further acquaintance with these is recommended to consult the volume itself, by the preparation of which Mr. Chambers appears to have made a valuable contribution to Meteorology.

DISCUSSION.

Captain **TOYNBEE** had read part of the work, and hoped to read the whole. He thought the diagrams very ingenious and instructive. He had been much struck by those which showed a relation between the land wind and barometric changes.

Captain **JINMAN** could not understand how the NE is a deflection of the SW monsoon, for the point of contact is distinctly marked by the clouds. It was a misnomer for it to be called the SW monsoon, for he had generally found it to blow from the WNW, especially in the Arabian Sea, between Ceylon and the Island of Socotra.

Mr. **SCOTT** mentioned that Mr. Blanford had stated that the so-called " SW monsoon " blew from the SE up the Ganges Valley.

Mr. C. **HARDING** considered the abstract very valuable, since it showed the contents of Mr. Chambers's volume in a very concise manner, and many would read the abstract who, for various reasons, would not be able to read the larger work. He was of opinion that the volume of results just published was a very valuable addition to the more detailed results given in the previous Bombay volumes. He expressed a wish to know Mr. Ellis's opinion of the smoothing operation; doubtless where used it would be hopeless to expect Bessel's formula to give results in agreement with original observations. He admired the diagrams, but considered them perhaps rather too numerous.

Mr. **ELLIS** considered the smoothing process adopted by Mr. Chambers to be quite satisfactory. Bessel's formula can be usually advantageously applied to diurnal variations of meteorological elements, but not always to annual variations, at least when the calculation is carried only to a few terms. Small and apparently real deviations in a mean annual curve do not get fairly represented, and in such cases an intelligent smoothing process is to be preferred, that is to say when the object is not to analyse the curve, but to obtain the best mean curve.

The following Papers were read :—

" Experiments with Lowne's Anemometer." By Captain **WILLIAM WATSON**, F.M.S. (p. 77.)

" Meteorology of Bangkok, Siam." By J. **CAMPBELL**, Staff-Surgeon, R.N. (p. 82.)

" Six Months' Observations at Calvinia, Cape Colony." By **KAUFMANN** I. **MARKS**, F.M.S.

CALVINIA, a village distant about 250 miles NNE from Cape Town, is situate in lat. 31° 20′ S and long. 19° 50′ E, and is about 2,850 feet above sea level. It consists of about fifty houses, and lies on a plain surrounded at an average distance of 4 miles by mountains, except to the W and SW, 800 to 1,200 feet high. From NNW round by N to ESE the configuration is flat, somewhat like Table Mountain, but in other directions the shapes are various. The highest is due S. A river runs out from the NW to the south of the village, and after heavy rains the water from the mountains rushes down it for a day or so according to the amount of rainfall, but is soon left dry, after the fashion of the majority of

South African rivers. The soil is sand and clay, and very fertile if it receives its due amount of moisture. Wells are sunk for drinking and domestic purposes from 12 to 30 feet deep according to their distance from the river, those nearest to it yielding fairly good water, clear but hard, whilst in those farthest away the water is brackish. It was my intention when first arriving to complete a set of three years' observations, but I was unable to stay longer than six months. The hygrometrical and 8 a.m. observations are incomplete. I had two screens for thermometers, which I procured from the Meteorological Office, London, being the handiest I could get for taking up country, and consisted of a hygrometer screen and a self-registering screen, both painted white; the louvres of the hygrometer stand were smaller and closer together than those of the other, and at certain times of the day, especially between 10 a.m. and noon on a summer's morning with a hot sun and no wind, the thermometers in the hygrometer stand would sometimes read 3° higher than those in the self-registering stand, but early in the day and at night and during breezy weather the difference was very slight, sometimes *nil.* I always read off at each observation the minimum thermometer with the dry bulb, the average difference being 2° in favour of the latter. As I am still taking observations with these two screens, I think it advisable the above explanation should be given, as it will hold good for future communications. These screens are far from being perfect, and it is probable a large double louvred stand would give a truer temperature, but I could not get any other than the sea screens. The screens were fixed 2 feet apart against posts close to a garden where vegetables grew, the bulbs of hygrometer and minimum thermometers being 4 feet above the ground, the maximum a few inches higher; the sun shone on the screens from sunrise to sunset. The dwelling house was distant about 100 yards, and there was a small tree to the WSW some distance off; the exposure was more open to the E, SE, S, and SW, than to the other points of the compass. The face of the screens opened to the SSE.

The hygrometers were ordinary B.T. thermometers by Hicks; the minimum was a sensitive Rutherford fork bulb, and the maximum on Phillip's principle, both by Casella. These had been tested at Kew Observatory, and the corrections have been applied to the observations. For six weeks I used a large bright bulb sun thermometer *in vacuo*, unfortunately one day I found it broken; it was fixed about 3 feet above the roof of a hut made of baked clay, the safest place I could find; its errors were unknown, the bulb being bright, it could not register the maximum heat of the sun's rays, neither was there any means of testing its vacuum; however, I annex the results of the six weeks' observations, as they may give a small idea of the warmth of sun during that period. October 7th to November 20th, mean maximum 120°·5, highest maximum 137°·7 (shade maximum 98°·1), lowest 97°, (shade maximum 51°·9), mean shade maximum in the forty-five days 71°·5.

The barometer employed was a siphon mercurial one by Negretti and Zambra until the 7th November, when I used a Kew barometer by Adie (corrected at K.O.); the siphon had been examined at the Cape Observatory, its correction being + 0·0044 inch. The rain was measured in an ordinary Negretti's 5-inch copper gauge, and was exposed in an open spot. It was emptied every twenty-four hours ending 8 p.m., and is entered on the day it fell. From the 11th September until the 20th December, I had fixed up a small Robinson's anemometer; the readings are not given, as the exposure to the N and NE was bad; it was set up on the same roof as the sun thermometer, but about 8 feet higher; the results for the 101 days are as follows:—mean miles of wind in twenty-four hours = 201 miles, maximum amount in twenty-four hours ending 8 p.m. on the 26th November = 510 miles, minimum on the 14th October = 88 miles. This instrument, the sun thermometer and the syphon barometer, were kindly lent by the Meteorological Commission for the Cape of Good Hope. No observations were taken on nocturnal radiation; firstly, grass is unknown, secondly, what with Kaffirs, Hottentots, Ostriches, &c. the instrument would speedily be either broken or stolen. As the sky is generally clear at night, and wind being the exception, the amount of radiation must be great.

Pressure. The shortness of these observations prevents me giving any reliable particulars as to the amount of diurnal variation. From the few notes I have taken it appears that both this amount and the period of maximum and minimum are very variable; at times during fine weather the daily variation is hardly traceable, especially so with a rising barometer, and at other times also during fine weather it amounts to nearly 0·1 inch. The pressure decreases before rain, but often falls before a strong wind without rain. A high barometer is generally associated with a strong SE wind and cloudless sky, probably a continuation of the Cape "South Easters." The monthly range is small, rarely exceeding ·50 in., mean in the six months being ·409 in. The lowest pressure observed was 26·482 in., the highest 27·098 in., extreme range ·616 in. Greatest fall in twenty-four hours was ·240 in., and the greatest rise ·233 in.

Temperature. The range is great, mean in the six months 30°·7, the greatest 36°·6 in December, and the least 23°·5 in June, and 24°·4 in July. From August the sun's rays are very hot, but the shade never feels oppressive even in the middle of summer. Frosts often occur, the minimum fell to 32° or below, three times in July, ten times in August, nine times in September, and twice in October. Snow fell in June, and remained on the mountains unmelted for some days. From residents I was informed this winter was unusually mild.

Humidity. These observations are incomplete. Mean at 8 p.m. 63·3, saturation 100. On August 3rd at 8 p.m. the relative humidity was 31·1 with a north wind, force 5 (B.S.), this was the lowest reading registered at the stated hours of observation.

Rain. Being on the debatable ground between the summer and winter rain tracts, Calvinia district is subject to periodical droughts. The preceding summer and winter had been dry, and very little rain fell until October, when it came in the nick of time, some of the Boers getting good harvests. Rain is here one of the principal topics of conversation, a rainy day, like in Australia, being spoken of as nice "fine weather." There are two descriptions of rain—from thunderstorms, and from "mist" weather, as it is called; the former occur generally in the summer, and are occasioned by a mixing of the NE (dry) and the NW (moist) currents, the latter principally in the winter, and come up from the Atlantic, which is distant about 85 miles.

Winds. Are not variable, being generally in fine weather SE at sunrise, veering round gradually to N at noon and W at sunset, blowing strongest in the middle of the day; in rainy "mist" weather the wind is either NW or WNW all day, blowing steady, whereas the other winds are "puffy" in character. If the wind keeps during the afternoon and evening in a NE direction, thunderstorms may be with certainty expected. The direction of the wind is given as magnetic, the variation being, I believe, 31¼° W. The N wind is the warm wind, and in winter it raises the temperature some 15° to 20°, and blows with a force of 4 to 6.

Cloud. The amount is small, the average at the stated hours of observing for the six months being 3·0 at 8 a.m., and 1·9 at 8 p.m.; the minimum mean monthly amount was 1·4 at 8 a.m. and at 8 p.m. 0·7 in December; maximum amount at 8 a.m. 3·7 and at 8 p.m. 2·7 in October. There was but one overcast day in the whole period—the 13th of July, when the range of temperature was only 3°·9, and there were forty-three days without a cloud. The predominant cloud is the cirrus; the next in importance is the cirro-cumulus, then the cumulus, which is not the fine weather cloud, being generally the *avant-garde* of thunderstorms.

Direction of Clouds. Generally from NNW, NW, and W, very rarely from any other quarter; during thunderstorms and rainy weather there are cross currents, after rain the clouds generally veer round to a SE direction, and gradually disappear as the weather clears.

Thunderstorms. Occur mostly in summer and spring, and are not severe, passing over very quickly; they gather in two or three parts of the sky, the wind generally blowing "out" from the storm cloud, say the wind is E, thunder cloud to NE, this cloud would disperse, another storm cloud would come up from NW, the wind would then suddenly rush out from the NW and blow for five or ten minutes with a force of 5. The following is an extract from my diary on this subject:—October 3rd, "4 p.m. Calm. Forked lightning to NNE with occasional thunder, heavy shower of rain at 1.45 p.m., heaviest to NE. 2 p.m., wind NE (3), light showers, with occasional *l* and *t* to NE. 2.45 p.m., storm appears to have passed by, heavy rain to N.E. 4.15 p.m., very black storm clouds with white scud gathering to E and SE, wind suddenly ESE (4), upper current from NW, the lower from SE, no rain. 4.55 p.m., wind SE (3), a little rain falling, no lightning nor thunder observed, barometer very steady until 2 p.m., then began to rise a little."

Mists and Fogs. Mist fogs were observed once in June, once in July, and twice in August; they come on a couple of hours before sunrise and disappear about two hours after, according to the strength of the sun. They precede rain. In each instance a perfect white fog bow was seen—colour, a dingy white, faintly red on the outer edge, a little "Scotch mist" falls at the time.

Duration of Sunshine. The amount is large; constant sunshine being represented by 100, the mean proportional amount for each (five months) day was 81; being most in December with 94, and least in October with 71. There were eighteen days of continued sunshine in September, and nineteen in December. There were twelve days in December without a cloud.

The coolness of the summer nights is shown by the thermometer reading between 50° and 45° fourteen times, and between 45° and 40° seven times in December. The temperature in the shade never reached 100°, although five times it was very close to it. Afterwards in the following January (1878) at Spitskop, a farm about 20 miles E of Calvinia, and about 200 feet higher, I registered 104°·7. With respect to the time when the lowest temperature occurs, I have noticed on a great many mornings, especially when dewy, the sky cloudless and no wind stirring, the minimum takes place between five and fifteen minutes after sunrise. In almost all cases there is a decided fall at and just after sunrise. I am continuing observations at Spitskop with three daily readings, at 8 a.m., noon, and 8 p.m., and hope at a future period to have the honour of presenting the Society with a more interesting and complete paper than the present one.

Abstract of Meteorological Observations taken at Calvinia, Cape Colony, 1877.

Months.	Barometer.		Air Temperature.							Dew Point.	Rel. Humidity.	Amount of Cloud.	
				Means of		Absolute Min. and Max.							
	8 a.m.	8 p.m.	8 p.m.	Min.	Max.	Min.	Date.	Max.	Date.	8 p.m.	8 p.m.	8 a.m.	8. pm.
	In.	In.	°	°	°	°		°		°			
July	26·821	26·802	51·6	41·2	65·6	23·9	30	74·6	21	40.8	67	3·3	2·0
August ..	·820	·806	49·2	36·8	69·7	22·9	19	85·2	23	39·3	69	3·1	1·6
September	·806	·774	54·8	38·9	73·7	24·4	14	90·9	7	42.5	63	2·4	1·9
October ..	·731	·703	59·1	46·3	76·3	29·0	23	98·1	17	47·0	64	3·7	2·7
November	·749	·720	62·1	47·2	79·8	35·7	15	97·3	30	45·7*	59*	3·4	2·4
December	26·762	26·736	63·4**	47·7	84·3	35·3	4	97·1	1	47·4**	56**	1·4	0·7

Months.	Total Duration of Sunshine.	Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
		Total Fall.	Greatest Fall in 24 hours.															
			Amnt.	Date.	Rain, Snow or Hail.	Thunderstorms.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	h.	In.	In.															
July	..	0·865	·495	13	5	1	6	1	0	5	8	14	10	0	1	5	3	13
August	177	0·215	·170	10	4	1	5	0	0	2	0	13	10	1	4	9	4	19
September ..	296	0·367	·260	9	3	1	8	0	1	1	1	17	6	0	0	17	2	15†
October	280	2·865	1·030	26	7	5	3	0	0	2	4	14	3	0	0	22	1	16
November ..	323	0·585	·350	26	3	1	6	0	0	0	1	4	4	0	3	30	1	17
December ..	416	0·070	·070	20	1	0	12	0	0	2	1	2	6	1	4	27	5	14

* For 24 days only.
** For 19 days only.
† One observation lost.

The Meeting was then adjourned.

Donations received from October 1st to December 31st, 1878.

Presented by Societies, Institutions, &c.

Adelaide	Observatory	Meteorological Observations, February to April.
Bombay	Meteorological Office	Report on the Administration of the Meteorological Department in Western India, 1877-78.
Brisbane	General Registry Office	Preliminary Statement of the Vital Statistics, 1877.
	„ „	Report on the Vital Statistics, June to September.
Brussels	Académie Royale	Annuaire, 1877, 1878.
	„ „	Bulletins. Tomes XLI.-XLV.
	Observatoire Royal	Bulletin Météorologique, September and October.
Calcutta	Meteorological Office	Report on the Meteorology of India in 1876.
	„ „	Indian Meteorological Memoirs, Vol. I. Part II.
	„ „	Report on the Administration of the Meteorological Department of the Government of India, 1876-1877.
Copenhagen	Danske Meteorologiske Institut	Bulletin Météorologique du Nord. September 1 to November 30.
Cracow	K. K. Sternwarte	Meteorologische Beobachtungen, August to October.
	„ „	Meteorologischen Beobachtungen, 1872-75.
Dorpat	Kaiserliche Universität	Meteorologische Beobachtungen angestellt in Dorpat, 1876.
Dublin	Royal Irish Academy	Proceedings, Science, Vol. II. No. 7, Vol. III. No. 1; Literature, Vol. I. No. 12.
	„ „	Transactions, Science, Vols. XXV. and XXVI.; Literature, Vol. XXVII, Part I.
Fiume	I. R. Accademia di Marina	Meteorological Observations, June to September.
Geneva	Société de Géographie	Le Globe. Tome XVII. Livraisons 2 and 3.
Hamburg	Deutsche Seewarte	Wetterbericht.
Lisbon	Academia Real das Sciencias	Jornal de Sciencias Mathematicas. No. XXIII.
	Observatorio do Infante D. Luiz	Annaes, Vol. XIV. 1876. Temperatura do Ar em Lisboa, 1856-1875.
	„ „	Postos Meteorologicos, 1876. Part I.
London	General Register Office	Weekly Returns of Births and Deaths, Nos. 39-51.
	General Register Office	Quarterly Return of Marriages, Births, and Deaths, September 30th.
	Meteorological Office	Daily Weather Reports.
	„ „	Weekly Weather Reports, Nos. 33-46.
	„ „	Hourly Readings, November 1877, to February, 1878.
	„ „	Bulletin quotidien de l'Algérie, May 1 to December 15.
	„ „	Report of the British Association, 1877.
	„ „	Reports to the Permanent Committee of the Vienna Congress on Atmospheric Electricity, Maritime Meteorology, and Weather Telegraphy.
	Royal Astronomical Society	Monthly Notices, Vol. XXXVIII. No. 9; Vol. XXXIX. No. 1.
	Royal Society	Proceedings, No. 190.

London	Society of Arts	Journal, Nos. 1350-1362.
	Society of Public Analysts	The Analyst, Nos. 31-33.
Madrid	Sociedad Geográfica	Boletin. Tomo V. Nos. 1 and 2.
Melbourne	Observatory	Monthly Records of Results of Observations in Meteorology, terrestrial Magnetism, &c. June to August.
	Royal Society of Victoria.	Transactions and Proceedings, Vols. XIII. and XIV.
Mexico	Ministero de Fomento	Boletin. Nos. 26-52, 54-67.
Modena	R. Osservatorio	Andamento Diurno e Annuale della Velocita del Vento del Prof. D. Ragona.
Moncalieri	Osservatorio del R. Collegio Carlo Alberto	Bullettino Meteorologico, 1878, Nos. 1-5.
	„ „	Osservazione Meteorologiche, August to October.
New Haven	Connecticut Academy of Arts and Sciences	Transactions, Vol. III. Part 2. Vol. IV. Part 1.
New York	Central Park Observatory	Abstracts of Registers from Self-Recording Instruments, September to November.
Paris	Bureau Central Météorologique	Bulletin International.
Philadelphia	American Philosophical Society	Catalogue of the Library, Part III.
	„ „	Proceedings, No. 101.
Rome	Ministero della Pubblica Instruzione	Bollettino Mensile, April to June.
	Osservatorio del Collegio Romano	Bullettino Meteorologico, August, No. 1-5.
Sydney	Royal Society of New South Wales	Journal, Vol. XI., 1877.
	„ „	Report on the Construction and Working of the Railways of New South Wales during 1876.
	„ „	Remarks on the Sedimentary Formations of New South Wales.
Tokei	Imperial Meteorological Observatory	Meteorological Observations, May to July.
Toronto	Meteorological Office	Report of the Meteorological Service of the Dominion of Canada.
Upsala	Observatoire de l'Université	Bulletin Météorologique Mensuel, January to April.
Utrecht	K. Nederlandsch Meteorologisch Instituut	Maandelijksche Wind-kaarten van den Noord-Atlantischen Oceaan.
Vienna	K. K. Centralanstalt fur Meteorologie und Erdmagnetismus	Beobachtungen, August to September.
	Oesterreichische Gesellschaft fur Meteorologie	Zeitschrift, Nos. 21-27.
Washington	War Department	Monthly Weather Review, August to October.
Watford	Natural History Society	Transactions, Vol. I. Part 10. Vol. II. Parts 1 and 2.
Zürich	Meteorologische Centralanstalt der schweizerischen naturforschenden Gesellschaft	Schweizerische meteorologische Beobachtungen, 1876, Part 6; 1877, 4; 1878, 1.

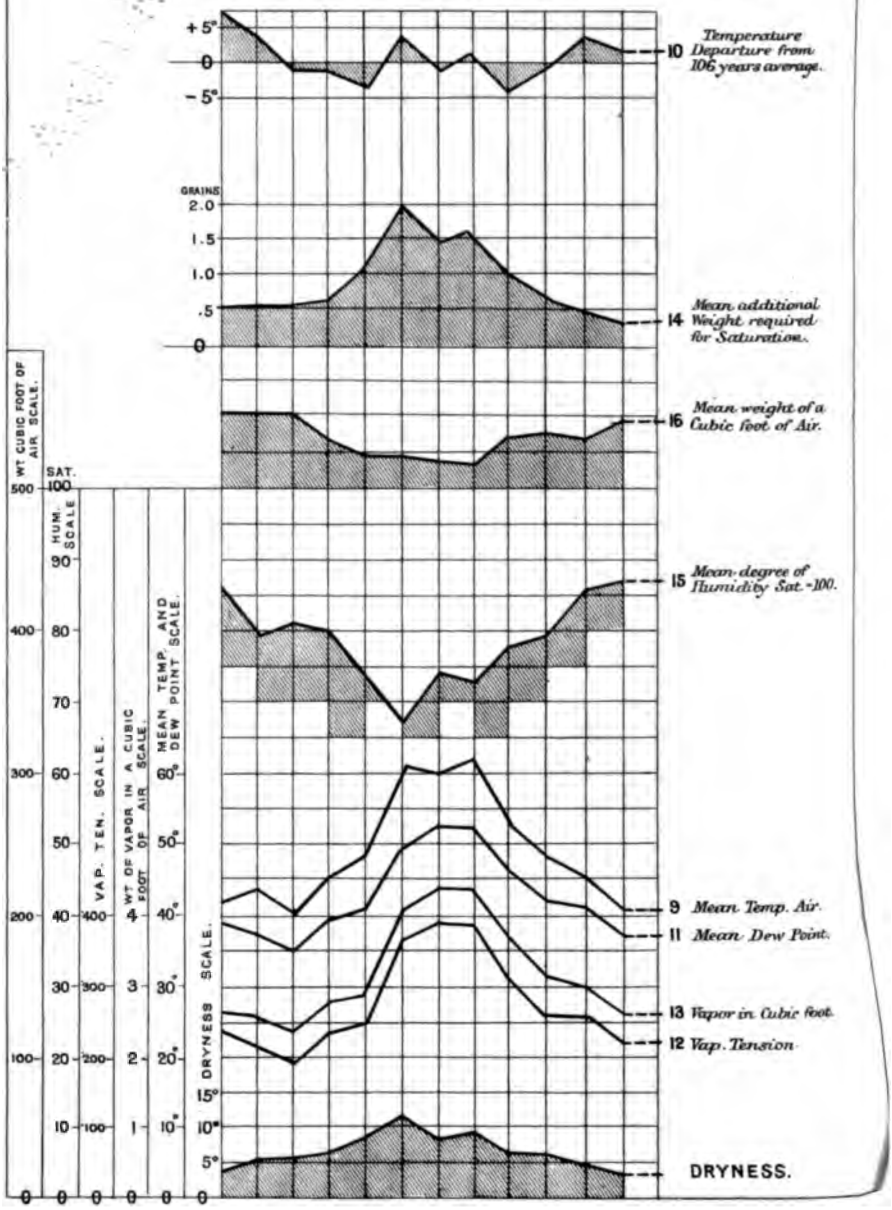
Presented by Individuals.

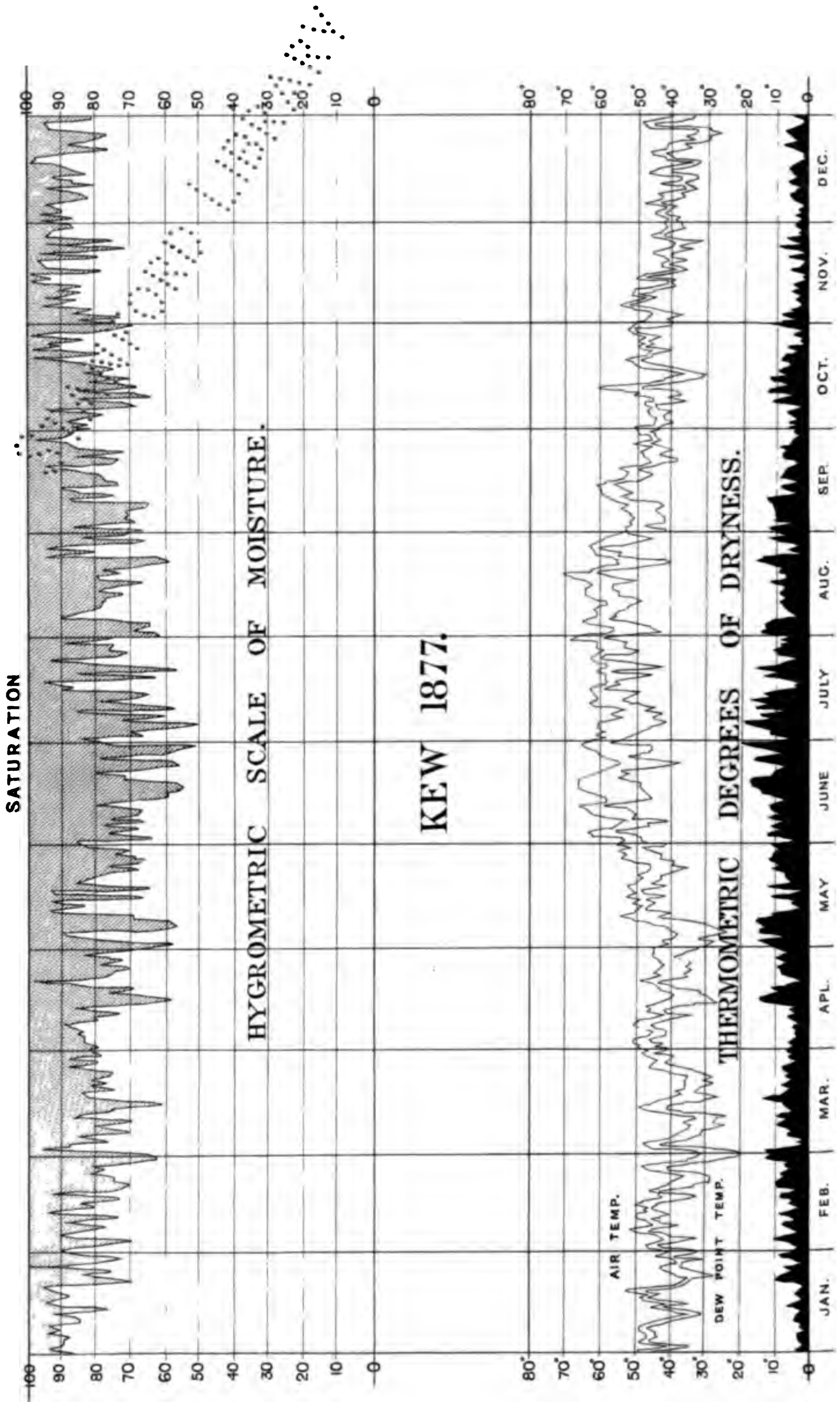
Archibald, Prof. E. D., B.A.	The Rainfall of the World.
Dunlop, W. H.	Results of Meteorological Observations made at Annanhill, Kilmarnock, September to November.
Fritsch, Dr. K.	Jährliche Periode der Insectenfauna von Oesterreich-Ungarn. III, Die Hautflüger (Hymenoptera).
Greaves, C., F.G.S.	Le Grand Ballon Captif à Vapeur de M. Henry Gifford.

Hankinson, R. C.	Weather at Red Lodge, Southampton, September to November (MS.).
Hoskins, S. E., M.D., F.R.S.	Meteorological Observations, Guernsey, September to November.
Lake, W. C., M.D....... .	Third Report of the Committee on the Meteorology of Devonshire, 1877.
Lowe, E. J., F.R.S.	Rainfall at Highfield House Observatory during the past 39 years (1840-78).
Miller, S. H., F.R.A.S.....	Prize Essay on Evaporation.
Preston, Rev. T. A., M.A.	Wiltshire Rainfall, September to November.
Silver, S. W., F.R.G.S.....	The Colonies and India. Nos. 320-332.
Spooner, W. C.	On the Failure of the Turnip Crop; the Cause and Remedies.
„	The Lessons taught by a Wet Harvest.
Symons, G. J., F.R.S. ...	Symons's Monthly Meteorological Magazine, October to December.
Taylor and Francis, Messrs.	Taylor's Calendar of the Meetings of the Scientific Bodies of London for 1878-79.
The Editor..............	Academy. Nos. 335-347.
„	L'Electricité. No. 14.
„	Nature. Nos. 466-478.
„	Nautical Magazine. November.
„	The Sanitary Record. Nos. 223-235.
„	The Telegraphic Journal and Electrical Review. Nos. 136-141.
Whitmore, J., M.D.	Health and Meteorology of Marylebone, September to November.

GREENWICH 1877.

From the "Annual Summary" Registrar General Table 25.





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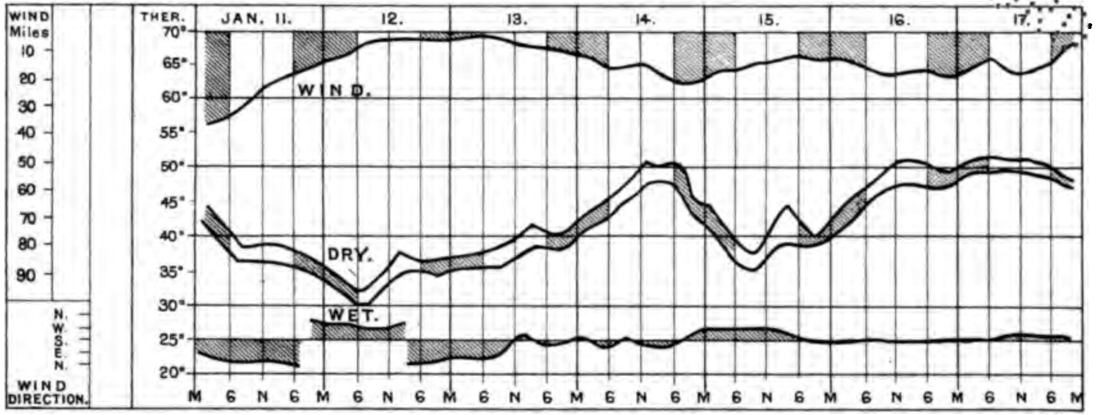
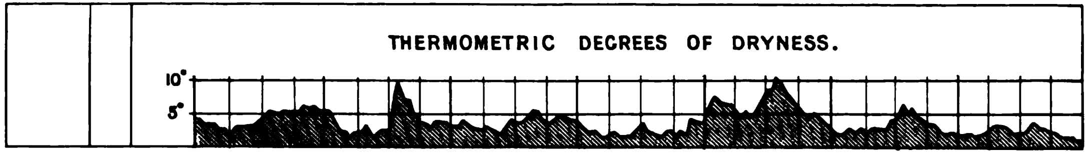
KEW. WINTER. 1877.



THERMOMETRIC DEGREES OF DRYNESS.



Difference between Air and Dew Point Temperatures plotted from a base line.

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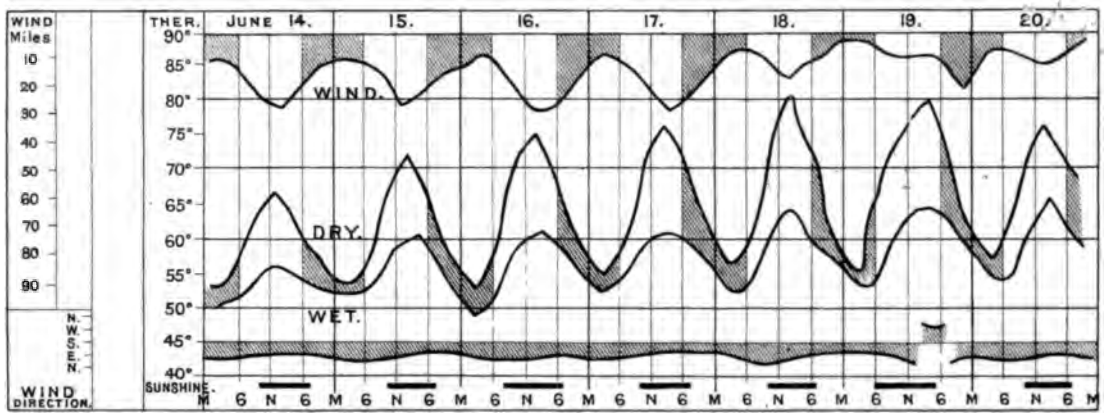
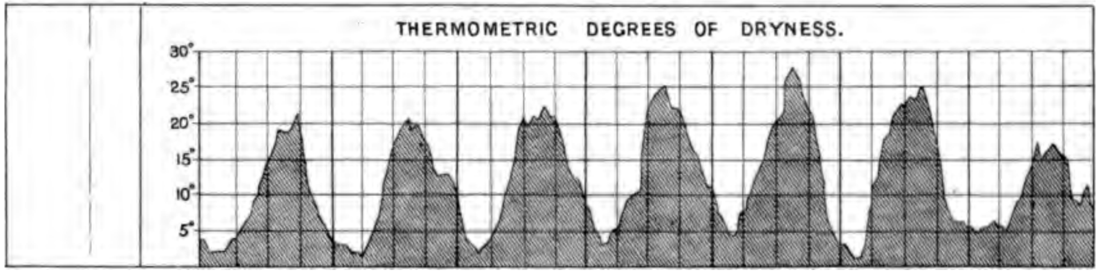
Quart. Journ. Met. Soc. Vol. V. Pl. XX.

KEW. SUMMER. 1877.





Difference between Air and Dew point temperatures plotted from a base line.

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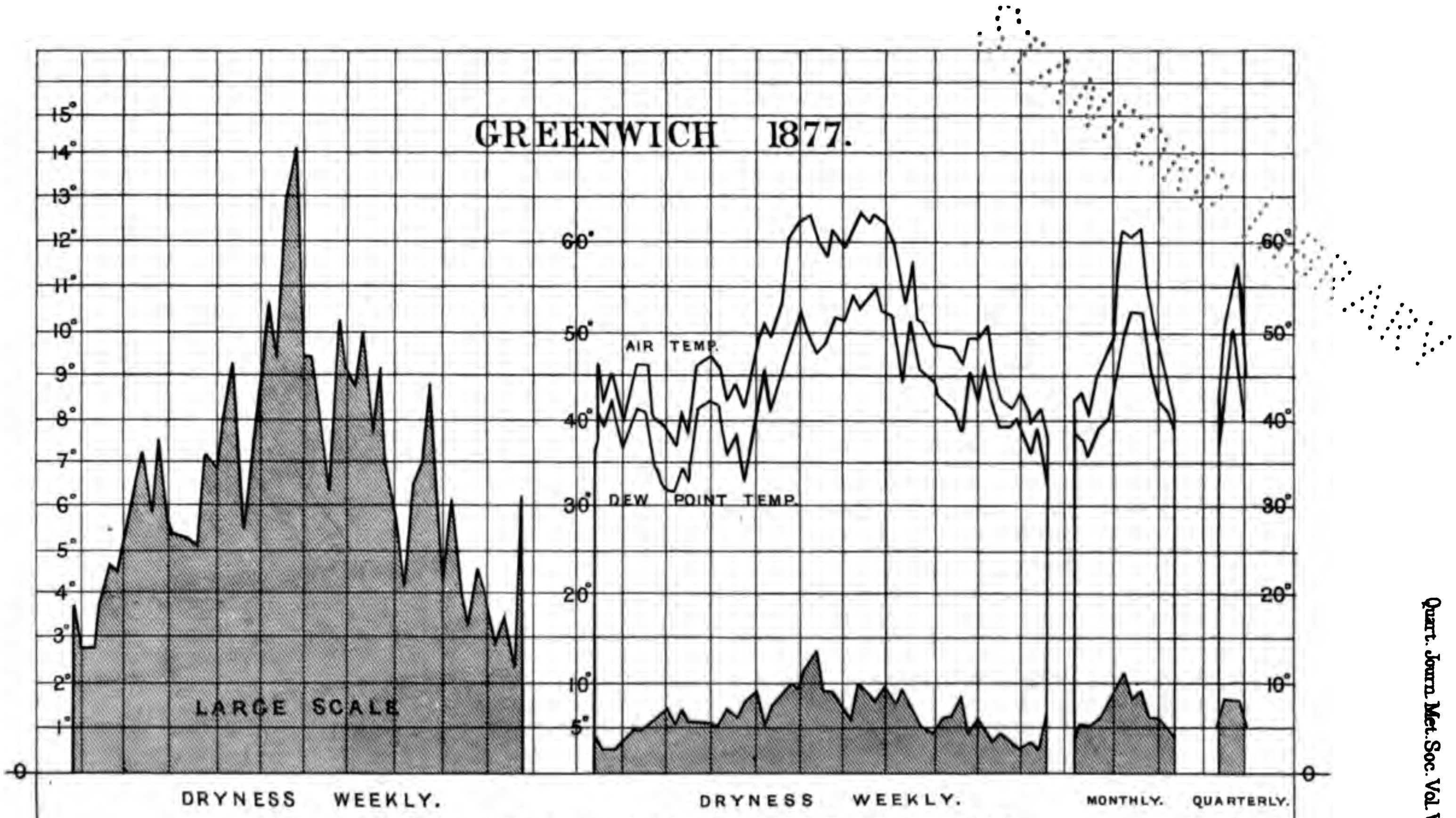

Dryness is shewn in Thermometric degrees plotted from a level base.

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QUARTERLY JOURNAL

OF

THE METEOROLOGICAL SOCIETY.

VOL. V. No. 30.

An Address delivered by the President, CHARLES GREAVES, M.Inst.C.E., F.G.S., *at the Annual General Meeting, January 15th*, 1879. (Plates XVII.-XXI.)

IT is a time-honoured practice for your President to deliver annually, as on this day, an Address, and I shall not depart from the custom.

I shall not be able to lay before you any interesting novelty, to foreshadow any new practice for future action, or to condense into a brief summary the experience of the past. I should have liked very much to have been able to give you a detailed account of all that is now being done in the way of observation; because no one can pay even the most cursory attention to Meteorology without feeling a wish to know what each observer or observatory is doing.

The advances in Meteorology in future will be greatly dependent on synchronous work, synoptic diagrams, and frequent crucial tests of results, by obtaining, at certain stations and at certain times, all possible combined observations simultaneously and similarly carried out.

These accounts I am unfortunately not able to draw up, yet I may venture to throw out a hint that such a summary of information would be very generally acceptable and immensely useful, seeing the great amount of time and money that has been wasted in re-observing and recapitulating facts, quantities, and movements of all kinds, in an unconnected and desultory manner.

Failing of success in obtaining any collation of this general knowledge, I have thought it wiser to confine my observations to the subject with which, as an engineer, I am most familiar, and in which I have not met with many co-labourers.

It will be within the knowledge of most of you that I carried out for several years a set of gaugings on Rainfall; on the Percolation of Rainwater into earth; on the Evaporation of Water from earth; and also the Evaporation of Water from a body of water. The paper in which these matters were treated of was read at the Institution of Civil Engineers, on February 29th, 1876, and I circulated copies of it pretty freely, so that the subject has possibly already attracted your attention.

The observations that have been made since the end of 1873, to which date the tables came down, have not at all invalidated any of the first conclusions, but generally support them, and we may hope for an extension of the series. But in the sequel to that paper I expressed my hope that some one would bring to our aid a computation of the rate of evaporation of, or from, water, derived from knowledge of the power of the atmosphere to cause and support, or to counteract evaporation. My ally has not appeared, but neither has any one shown the spirit or form of an antagonist.

Having somewhat more leisure than formerly, I began to work at the matter myself, being desirous of knowing whether it was at all possible to learn and know what should be the result on any body of exposed or natural water, corresponding to the registered data of atmospheric conditions. Now, I venture to say that many of you have attempted the same thing; some of you, perhaps, with more success than myself; but feeling that there were reasons *why* little progress was made or possible, I have thought that I could not employ this opportunity better than by puttting forward some views on this branch of the study of Hygrometry.

The point to which I shall endeavour to lead you is, that at present all our knowledge and appreciation of the evaporating power of the atmosphere is sunk in the word Humidity.

Now I am not going to run a tilt at the name, or the fact, or the value which expresses humidity, or the tables which record it. They are all necessary, and we cannot in any way do without them. The expression is philosophical and convenient; it brings to the mind a value easily appreciated, and capable of that ready comparative use which is essential in all practical science.

But consider now the course by which we reach our knowledge; and the instruments to which I shall refer are only those of ordinary, I may say of now universal use, the dry and wet bulb thermometers. The dry bulb is the usual source of our knowledge of air temperature, for hygrometric purposes at least. The temperature of the wet bulb is the temperature of evaporation. The temperature of the dew-point is the temperature of condensation. That, between these two, a necessary alliance and connection exist, is plain; indeed, on this fact depends our knowledge of the dew-point temperature. Through the knowledge of the dew-point we progress to our knowledge of the degree of moisture, and of the quantity of moisture which there is in the air; but will it not appear to you on consideration that this humidity is not the active property of the atmosphere? What can the wetness of the atmosphere do but wet? The power to dry is not obtained out of a measure of the power to wet. A scale of inability can never lead us to a measure of ability.

And when I say that humidity is not the active property of the atmosphere, I will go further, and say that it is the passive property; that if, when we have tabulated all the various forms in which we are able to show the condition of the atmosphere, we sum them up in the final humidity or degree of saturation, we are reduced to the consideration of a sad, damp, inactive, sodden state of things, and to the study of an atmosphere, without any active force, ready only for the absorption of miasma poisons.

Now let us take a more cheerful view. I define as "dryness" the difference between the temperature of the air and of the dew-point. Now it is my thesis to maintain that we do ourselves great wrong by not estimating, tabulating and continually keeping before our eyes a knowledge of the dryness; and that, with a degree of respect greater even than is habitually paid to "humidity."

Dryness is the active power of the atmosphere; it is operative incessantly, or so nearly so, that the short periods when saturation is complete are as nothing when compared with the great extent of those when saturation is incomplete. Now it may be said that dryness is really only the complement of humidity; and that the figure which represents the difference between humidity and 100, is as good an expression of dryness as can be wanted. In some sense this is true. The complement of humidity may be made an item of meteorological record; and if a diagram of a curve, a tabular form, or a comparative series, were all that is wanted, there might be satisfaction obtained by giving heed to this complementary quantity. But what is it to be called? In that shape it has but a casual connection with its zero, and no consummation. Humidity has its totality, a fact that is kept constantly before us by the expression "per cent.": but dryness proper has its zero always present to our minds; and its natural values are directly progressive.

Now my proposal is that these two tables or columns of humidity and dryness should be concurrent in all registers, and that one should not appear without the other.

Let us consider again for a moment what are the functions of dryness,—how many of the affairs of life and health are dependent on it; how much of the enjoyment of nature, of the means and opportunities for exercise, of dress, travel, operations by land and water, arts, trades, and manufactures. More important than all these are the processes of vegetation, and the operations of farming, for which the atmospheric conditions are more attractively announced under the expression of six degrees of dryness than of 80 per cent. of humidity.

It may be that the hard truth is equally clear under either expression; but of this I am certain, that to know nothing of the hygrometric state of the air, except as a heavy percentage of humidity, is deterrent from the study, deterrent from the habitual use of a scientific standard, productive of a nauseating sense that no further knowledge can be procured by hygrometric research; and this eventually ends in the results being placed in their respective tabulated places, and there left.

Having set myself down to study evaporation, this condition of knowledge was eminently unsatisfactory; but I have, after much inquiry, found that the state of hygrometric knowledge is in a peculiar position, and that, so long as the forms of record, the system of tabulating, and the method of expressing results remain as they are, individuals, however interested, are unable to propound any comparison, to challenge the correctness of practical results, or to offer any method of their own which could lead to even a surmise of the magnitude of the natural effects which one can measure practically.

Now the whole basis of hygrometric knowledge consists at present in the study of the wet bulb thermometer. I omit any reference to Daniell's or Regnault's or any other hygrometers, because the use of them is small, possibly diminishing, and resorted to only under some special temptations or inducement. The dry bulb records I take to be the expression of temperature in a more general sense, independent of hygrometry, and requisite whenever temperature has to be studied at all. The wet bulb observations lead at once to the discovery of the dew-point or to that of vapour tension, *i.e.* the elasticity of the vapour. Obtaining these, an extensive series of expressions becomes possible which may develop ideas or elucidate views: Such are:—Weight of vapour in a cubic foot of air:—Additional weight required for saturation:—Degree of humidity:—Weight of a cubic foot of air. To these I wish to add Dryness.

These are, however, all expressions differing but slightly; but whatever may be the purpose in the mind of any student, the maximum of knowledge appears to be wrapped up in the expression Relative Humidity. Now relative humidity is a very useful expression. There is nothing that would be a substitute for it, nor, as far as I can see, is there anything that would supersede it. But it is strictly a relative, not an absolute expression: it is the relation which the humidity at any stated time bears to the humidity of complete saturation. And it is not, in any way, an expression of the power of the atmosphere. It is a mere passive expression; it represents no working power in the atmosphere, and so lands us in a barren and inoperative knowledge, out of which we fail to advance towards any practical results.

Where, however, do we look for an expression of the power in the atmosphere to dry up, to absorb, to remove moisture; a power which we are all continually cognizant of; a power which conduces almost entirely in this climate to make fine weather, to make healthy weather, to give an exhilarating condition to temperature which might otherwise exist but not be enjoyed; a power which carries back into the upper atmosphere the fallen moisture, and which, pervading all the multitudinous intricacies of agriculture and manufactures, is the leading feature for the description, for better or for worse, of all weather?

I do not say that we are without a numerical expression or a standard by which all this can be known. The difference between Relative Humidity and Saturation is in reality a measure of dryness; neither, after all the changes have been rung upon the varying forms of expression which characterise the deductions from the facts of the wet bulb, is there any thing which can go beyond the position that the difference between humidity and saturation is a scale of dryness. The difficulty hence appears to be that the difference between humidity and saturation would be a scale without a name and without finality, would be a difference only. This is necessarily so, because a scale of humidity is a scale of inability, and a scale of impotence can never give us a measure of strength.

The present condition of the expression of our hygrometrical knowledge then is this, that we want some method of denoting the potentials of the atmosphere in its hygrometric relations. The potentials of the atmosphere in relation to pressure have had a wonderful development since the propounding of the law that the movement arising out of inequality of pressure takes effect at a right angle to the gradient. It is but a few years since no one looked for movement except down the gradient, and the movement actually experienced never develops itself in that way. Now the theory is in advance, and observations can hardly keep pace in corroborating it.

It will be readily seen how the pursuit of some means of at least knowing, to say nothing of predicating, why and when water, moisture and vapour are taken up by, and again dissipated in the air from which they were derived, has led me into this line of view.

I am at a loss to see how meteorology can be made acceptable to the agricultural mind unless we can adopt some simple expression, showing how dryness, rather than moisture or humidity, is the result of certain conditions and combinations of the measurable elements.

I take the difference between the dew-point and the temperature of the air to be the best expression to represent Dryness. It has saturation as its zero, and must have an absolute dryness as its consummation; it is a measure as equally progressive as is relative humidity; its curves when laid down are exactly correlated to humidity, inverted however, with point opposite to point. Moreover, as the dew-point is a prime deduction from the dry and wet bulb observations, dryness is reached with no more figures than are required for humidity; indeed, nothing more is wanted in ordinary weather tables than an additional column, with dryness at its head.

There is no room for error; if dryness is wrong, humidity is wrong; if humidity tells a truth, dryness must tell the same, but the aspect is from the other or opposite side, and I may contend it is from the more agreeable side. The figure exhibiting the value is the difference between degrees and degrees, and may stand as a scale of degrees; although there is nothing of the true nature of thermometric degrees inherent in it, the alliance is, nevertheless, entirely thermometric. There is thus a distinct difference between the notations of humidity and dryness. Humidity leads up to saturation, and saturation is definite. It ends in a plenum, and therefore the quantity or degree may be stated as parts per cent. of the whole. Dryness is, so to speak, a vacuum, and cannot, therefore, be stated in the same way; the term is complete in itself; it starts from its own origin or zero, and has as close a relation to that zero, as humidity has to its consummation in saturation.

Now dryness is not expressed in any of the Tables of the Meteorological Office, nor in any tables of our own Society, nor in any of Mr. Blanford's numerous tables of Indian Meteorology. Neither do I find generally any tables of what is the stepping-stone to it, namely, the dew-point. Dew-point and dryness are deserving of a special table, and of the most prominent notice. Tension of vapour and humidity obtain place in full rank every where. It is true, one can, by a process not very lengthy, be obtained from the other. Tension is convertible into dew-point very easily; for there is only one dew-point which corresponds to one tension, at every point of air temperature; but the tendency of the study is shown by the facilities afforded in the tables which it has become the custom to produce. It is this absence of any expression springing from or leading to dryness that has led to a complete neglect of all study connected with the extent of evaporation due to atmospheric causes, of all comparisons between natural and obvious effects of that kind, and any corresponding instrumental observations. That there is an alliance between humidity and optical phenomena in the atmosphere, visibility and the secondary development of mist, fog, and clouds, is plain; that rain must be dependent on the amount of moisture which can condense and form it, is clear; but how can we properly appreciate the tendency which it has to form, unless we can see, under another aspect, how all these secondary developments are to disappear, and that dryness is the active agent by which they are made to disappear?*

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* In illustration of these matters, the following diagrams have been made and form an atlas numbered 1 to 26 inclusive, and are as follows:—

Diagram No. 1.—All the values from Mr. Glaisher's table 25, in the Registrar General's Annual Summary for 1877; viz. mean temperature of the air; mean dew-point; weight of vapour in a cubic foot of air; mean tension of vapour; mean degree of humidity; mean weight of a cubic foot of air. The curve of dryness is added at base.

No. 2.—The same (Greenwich) for 20 years, the years detached from one another, dryness curve added.

No. 3.—The same from 1848 (Greenwich) all continuous. This is a complete hygrometric weather diagram for 31 years. Dryness is added in place (red).

No. 4.—Average dryness and humidity, quarterly and annually, 1857 to 1877. This proves the intimate relation and similarity of the curves, and is useful to show whether there is any trace of a cycle or any regular period of increase and decrease.

Nos. 5 and 6.—Dryness and Humidity. Dryness to a larger scale than before, weekly diagram showing that the curves, being derived from the same source, are identical, being reverse only, but the aspect of one is from the dry side, and the other from the wet.

All the above are set up from one base line. The additional moisture wanted to saturate, and the comparison of temperature with average, are from independent bases.

Nos. 7 to 26.—The curves of thermometric dryness for the Kew Observatory, deduced from the daily tables supplied weekly, and published in the 'Illustrated London News,' from 1859 to 1878. The curves of mean temperature and of dew-point are also given for 20 years, from 1859 to 1878. The curve of thermometric dryness is given fully for every one of the above years, but in 1869, 1870, 1871, 1872, 1873 the mean temperature and dew-point have been omitted, in order to make room for others for which there was otherwise not place on the sheets. The curves of hygrometric humidity and thermometric dryness are both given for the years 1869, 1870, 1871, 1872, 1873. All the above curves exhibit the daily values, and no others being published for Kew, no attempt has been made to work up weekly, monthly, quarterly, or annual averages.

The curves of thermometric dryness are given for Greenwich weekly, monthly and

Now I am not able to give a complete illustration of the method of using the feature of dryness, or of the full benefit that would result in a hygrometric inquiry from having this feature prominently put forward; but for illustration I have selected two weeks of 1877 from the Kew diagrams as published in the 'Times,' one in winter and the other in summer. These are exhibited by Plates XIX. and XX.; the winter week is January 11-17. The mean humidity is 87·4. The humidity for each day is 85, 85, 87, 98, 77, 90 and 95, the temperature being low. The wind shows no response to the position of the sun, the dry and wet bulb curves are parallel all day, and yield but slightly to the sun's approach to the meridian, the whole week is most uninviting as a field for research and results, but there is the relative humidity, and maybe that term is sufficient, for nothing in this case can be obtained out of any other.

Take, however, the summer example week, June 14-20. The average humidity for the whole is 60·7, the humidity for each day is 65, 60, 60, 56, 55, 57, 72. The average dryness for the week is 14°·9, and the diagram is altogether inviting, giving a hope of finding strong evidence of an evaporating tendency, strong active property, and activity well developed. The motion of the summer air is greatly increased by the mid-day sun; the interval between the temperature of the dry and wet bulbs expands greatly at noon, and the difference between the wet bulb and air temperatures on the 18th of June reaches 16°·5. Separating the day and night temperatures by means of the tables of the hourly values published by the Meteorological Office,

quarterly, taken from Mr. Glaisher's tables in the Registrar General's Returns for the recent years, all in fact since 1859. The weekly dryness curve is also shown on a large scale. The Greenwich mean temperature and dew point are given weekly, monthly, and quarterly for the same years, viz. 1859 to 1878 inclusive. The Greenwich humidity curve is not given at all.

The scales are:—for Kew daily 20 days to an inch and 20° of temperature to an inch; for Greenwich weekly 20 weeks to an inch, 20° of temperature to an inch, except the enlarged diagram of dryness, which has 4° with 20 weeks to an inch. The same scale for thermometric degrees is used with the monthly and quarterly diagrams. The time scale is sufficiently clear on the diagrams. These diagrams afford a complete series for 20 years from 1859 to 1878 for both observatories, and are a full graphical exhibition of mean temperature, dew-point and thermometric dryness.

In addition to the foregoing atlas, I produce the following cartoons, numbered 1 to 5, inclusive, Plates XVII., XVIII., XIX., XX. and XXI. accompanying this Address being reproductions of the said cartoons:—

Plate XVII.—Same as atlas diagram No. 1. All the elements for 1877 taken from Glaisher's table 25 in the Annual Summary of the Registrar General, for Greenwich.

Plate XVIII.—Same as No. 25 of the atlas diagrams for the year 1877 for Greenwich. Mean temperature, wet bulb, dew point, daily; dryness and humidity daily for Kew.

Plates XIX. and XX.—The curves of the Kew Observatory for January 11-17 and June 14-20, 1877, as published in the 'Times.' These two plates contain the force of wind, the wet and dry bulb curves, duration of sunshine and corresponding dryness. These illustrate the conditions of summer and winter, and the combined influences of wind and dryness.

Plate XXI.—Mean temperature, dew-point and dryness for Greenwich, weekly, monthly and quarterly, 1877.

and adopting the scale of dryness all through, the high degree of dryness in the 12 hours of the day is made very evident. The motion of the air being divided in the same way, the combined action of heat and wind is capable of having a determined estimate made of it, and a scale is plainly within reach by which the evaporating power of the air can be strictly appreciated.

I give this only as an illustration of the way in which the potentials of the atmosphere may be rendered visible on diagram and table. I have not found time to reduce into evidence any long series; indeed the hourly values of 1877 have only been completed since I began to write this: but I hope to be able to follow out the same idea in comparison with some daily measurement of evaporation, and thus find practical use for the term and expression of dryness in a definite way. I shall be able to show many results which, as I said at the outset of my address, are now according to our own practice and nomenclature all buried and hidden under the passive, inactive, nay almost dormant, head and title of Humidity, and under such a heavy percentage of it as to look in imminent danger of constantly perishing in saturation.

I have however laid down, and I give in graphic illustration the dryness of Kew and of Greenwich for the last 20 years, in most cases without, but in several years in juxtaposition with the humidity. I have also displayed the humidity and dryness on a larger scale of degrees with a closer scale for time on several sheets, to which I invite attention.

Now I shall probably hear an early remark that none of this is new, that all that I have said is already well known and may be acted on if any one so wills, but that for judicious reasons other steps have been taken. I know not what occult reasons may have prevailed or may now influence masters and students of Meteorology: I am confident the reasons, if they exist, are bad.

I was working at this subject for some time having only in sight Mr. Glaisher's dryness in the Registrar General's Annual Summary and the difference column in the weekly returns of the Greenwich observations; but I soon found that I had in Daniell an able support for all these views, and I will append a few extracts.

"Thus does the hygrometer mark with infallible precision the comparative degrees of moisture and dryness in the atmosphere, and by exhibiting them in degrees of the thermometer, refer them to a known standard of comparison and speak in a language which everybody understands. But its observations may be made applicable to a much wider field of research, and adapted to still more important objects."*

"The dryness of the atmosphere may be conveniently expressed in terms of the thermometric scale; but it may be desirable also to know what it would be upon the natural scale of the hygrometer. In keeping a register, however, of observations, in which the final results are not calculated, the dew-point itself should always be recorded. By neglect of this the observations of the hygrometer published in the Philosophical Transactions are rendered nearly useless, as the mere records of the degrees of moisture on the hygrometric scale are of comparatively little interest, and the results of the hygrometer are thereby reduced almost to a par with those of a common hygroscope. Thus by two simple observations and very easy calculations we ascertain with precision the following points of the utmost interest to meteorology:—

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* "Meteorological Essays and Observations." By J. F. Daniell, F.R.S. Second Edition, 1827, page 153.

"Temperature of the air.
"Dew point.
"Degrees of dryness on the thermometric scale.
"Degrees of moisture on the hygrometric scale.
"Elasticity of the vapour.
"Weight of vapour in a cubic foot of air."*

Mr. H. F. Blanford, in his Indian Meteorologist's Vade-Mecum, Part I. Par. 65, in alluding to the principle of the wet bulb, makes the following potent observations:—"Most persons are acquainted with the action of wetted tatty in cooling the air that passes through it, and also with the common mode of cooling water by hanging a vessel of it surrounded by a wet cloth or damp straw in a shady place, exposed to a hot dry wind; or, what amounts to the same thing, in a vessel of porous earthenware, the outside of which is kept constantly wet by the water soaking through from within. In all these cases coolness is produced by the evaporation of the water; and the faster the water evaporates the greater is the cold produced. Thus it is with the wet bulb of the hygrometer; it is cooled by evaporation, and the temperature falls the lower, the more rapid the evaporation. The dry bulb thermometer shows the actual temperature of the air; and the difference of the readings of the dry and wet bulb increases with the rate of evaporation, and this again increases with the dryness of the air. It does not, however, increase in the *same* ratio at different temperatures, nor is the wet bulb ever cooled down to the temperature of the dew point."

In Part II, Par. 107, the same authority says:—"The quantity of vapour in the air at any place is, of course, mainly dependent on its distance from the sea, and upon the direction of the wind; partly also on the temperature, since, the higher the temperature, the greater the quantity of vapour that can exist in a given volume. As a general rule, therefore, the interior of India, and more especially the Upper Provinces, has a smaller quantity of vapour in the air than places situated on and near the coast line; but if the prevailing direction of the wind is from the land, and that land be dry and heated, places situated almost on the coast line may have an extremely dry atmosphere."

Throughout this valuable work on the meteorology of India we frequently find allusion to the very low humidity and consequently high degrees of thermometric dryness existing in the lower regions of the earth's atmosphere impinging on the hills and plains of the southern peninsula. It is from this extreme and tropical state of atmospheric phenomena that I think the term thermometric degrees of dryness would be most appreciated, and would very suitably express the condition of an atmosphere so much removed, on the natural scale of the hygrometer, from saturation, as to have its value in a great measure masked, by being given only as a percentage of saturation.

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* Meteorological Essay and Observations, p. 161.

Mr. Chambers, in his recently published work on the 'Meteorology of the Bombay Presidency,' page 62, par. 86, appears to be in the same line of thought; but not venturing to use the term dryness, he seeks to adopt, as a physical condition, the capacity of the air to receive more moisture, and says:—"The variations of the pressure of the vapour tell us very nearly the variations in the quantity of vapour contained in a given volume of air; but they do not tell us what power the air possesses of absorbing more vapour, because this power depends not only upon the quantity of vapour present, but upon the full capacity of the air to absorb vapour, and this in turn depends upon the temperature, increasing as the temperature increases; and so rapid is this increase, that within the range of the air temperature at Colába the capacity quadruples itself. The quantity called by meteorologists the relative humidity of the air, is the proportion of the vapour actually present to the maximum quantity which the air could contain at the existing temperature; and it is used as an arbitrary measure of the readiness of the air to change its condition of humidity, either to absorb more vapour, or to deposit, by condensation on cooling, some of that which it possesses. It is possible that, at Colába, the same number may represent the relative humidity when the temperatures are different, and yet the quantity of vapour which the air has power to absorb, without change of temperature, may, in the one case, be four times as great as in the other. It seems to us that some measure which has reference to one invariable material unit is much to be preferred, for scientific purposes, to this of relative humidity; and accordingly, we have chosen the additional vapour pressure that the air has capacity to receive without change of temperature as such a measure; a quantity that is proportional to, but more readily obtained than, the one sometimes used as the number of grains of vapour in a cubic foot of air required to produce saturation."

Why such an authority as Daniell should be neglected I cannot at all see. He is in accord with Dr. Dalton and Luke Howard on most points; indeed, they may almost be said to work together. His writing is plain and perspicuous, and his arguments clear and conclusive. But a strange disposition seems to have come over all the more recent authors. Thermometric dryness has given way to hygrometric moisture both as a deduction, a table, and an exhibition of atmospheric conditions. Dew-point has given way to tension, greatly in my opinion to the prejudice of knowledge, perspicuity and progress. The barometer men seem to have sat down on the thermometer men, and nothing will do for them but a scale reduced to inches of mercury, and percentage of saturation.

On this point I differ, and venture to think that in hygrometric matters it is wisest to keep the thermometer uppermost.

In the contrast between the summer and winter dryness, drawn from Kew

Diagrams (Plates XIX. and XX.), I have divided the days into 12 hours, and 12 hours, only for economy of time, and for simple uniformity of arrangement; there is no principle imagined. The desire is merely to draw together the more potent and less potent influences; and to exhibit the sums or accumulations of them. I have no intention in these diagrams and examples to put Kew and Greenwich into contrast, or to draw any comparison between their records or methods. I have selected examples from each in pure loyalty, feeling the advantage of having such a splendid double basis to work upon.

I have thus shown how the adoption of dryness as one of the items of study and record leads to a method that has great power in bringing back to its natural position the authority of the hygrometrical element among the primary and derived causes into which we subdivide the many influences that constitute atmospheric action.

I must wait for future opportunities of developing the information that is thus to be afforded. My own opinion is that it is very great and very important, but I am afraid that this fashion of bringing it forward reduces my address to the level of an ordinary contribution, while it should rather have been a summary of present knowledge and practice.

The addresses of my predecessors have, however, so entirely related to the achievements of observers and observatories, that I hope I shall be pardoned for taking this opportunity of showing a defect in the system into which we have apparently gravitated in the hygrometrical department.

If, in your opinion, I have said too much, it may I hope be excused under the anxiety which I feel to give all the importance possible to that branch of our study, and of the jealousy which I experience that we should be entirely dominated by the barometer.

REPORT OF THE COUNCIL

FOR THE YEAR 1878.

The Council have the pleasure of submitting to the Fellows a Report of their Proceedings for the past twelve months, and of the present position of the Society, now in the thirteenth year of its corporate existence. The chief features of the proceedings during the year 1878 have been the final completion, on a comprehensive and well organised basis, of the arrangements for systematic inspection of the Society's stations,—an object which has engaged the sedulous attention of successive Councils for the last four years;—and the delivery of a Series of Lectures on Meteorology by certain Members of the Council.

The Lectures were organised at the suggestion of the President, who has defrayed all the attendant expenses. They were delivered on successive Thursday evenings in the Theatre of the Institution of Civil Engineers, as announced in the following programme:—

I.—OCTOBER 31ST. "*The Physical Properties of the Atmosphere.*" By ROBERT JAMES MANN, M.D., F.R.C.S., F.R.A.S.

II.—NOVEMBER 7TH. "*Air Temperature, its Distribution and Range.*" By JOHN KNOX LAUGHTON, M.A., F.R.A.S.

III.—NOVEMBER 14TH. "*The Barometer and its Uses, Wind and Storms.*" By RICHARD STRACHAN.

IV.—NOVEMBER 21ST. "*Clouds and Weather Signs.*" By the REV. W. CLEMENT LEY, M.A.

V.—NOVEMBER 28TH. "*Rain, Snow, Hail and Atmospheric Electricity.*" By GEORGE JAMES SYMONS, F.R.S.

VI.—DECEMBER 5TH.—"*The Nature, Methods and General Objects of Meteorology.*" By ROBERT H. SCOTT, M.A., F.R.S.

They were open gratuitously to the public, and the average attendance at the Six Lectures was 170, many of those present being ladies. It has been arranged that the Lectures are to appear in a small volume, as the Council consider that such publication will help to extend the knowledge of the principles of Meteorology, and to bring the Society more promninetly into notice.

The Council take this opportunity of expressing their sincere thanks to the Council of the Institution of Civil Engineers for their great kindness in allowing the free use of their Theatre for the delivery of the Lectures.

The various Committees, with the exception of the Library Committee, which has been merged in the House Committee, were re-appointed at the first meeting of the Council after the Anniversary Meeting. The last-named Committee was increased from seven to nine Members, viz., The President, Three Secretaries, Mr. Brooke, Mr. Eaton, Dr. Mann, Mr. Strachan, and Mr. Tabor. The special function of this Committee is to examine and report on such general subjects as come before the Council in the usual routine of business, but for which there is not sufficient time for detailed and careful consideration at the monthly meetings. This course has been adopted in preference to holding additional Meetings of Council, because several of the members of that body reside in the country, and are unable to attend more frequently than once a month.

The Editing Committee was re-elected. Its members are Mr. Laughton, Dr. Mann and Mr. Scott.

The Observation or Station Committee was increased from three to seven Members, in consequence of the great development which has taken place in this branch of the Society's work. The important modifications in the printed quarterly reports of the observations from the Society's stations, which have been adopted by the Council, are due to suggestions of this Committee. The Members are the President, the Hon. Ralph Abercromby, Mr. Eaton, Mr. Ellis, Mr. Scott, Mr. Symons and Mr. Whipple.

The Lightning Rod Committee has been re-constituted. At the request of the Council of this Society, the Royal Institute of British Architects, the Physical Society, and the Society of Telegraph Engineers severally nominated delegates to form a joint Committee with the representatives of this Society. This Committee now consists of Mr. Brooke, Mr. Dymond and Mr. Symons on behalf of the Meteorological Society, and of Professor W. G. Adams, Professor

Ayrton, Mr. J. Latimer Clark, Professor G. Carey Foster, Professor T. H. Lewis, Mr. W. H. Preece, and Mr. J. Whichcord.

A Committee for organising and carrying out the arrangements for the Lectures before mentioned was constituted at a late period of the Session. The Members were the President, Mr. Eaton, Mr. Laughton, Dr. Mann, Mr. Scott, Mr. Strachan and Mr. Symons.

Finally, a Committee, consisting of the President, Mr. Dymond, Mr. Eaton, Mr. Field and Dr. Tripe, carried out the arrangements for the Testimonial to your Secretary, Mr. Symons.

The following tabular statement gives the dates on which the Committee Meetings were held, and shows the attendance of Members on each occasion:—

Committees.*		House.	Station.	Lecture.	Testi-monial.
February	1	..	4	..	..
,,	5	7	4	..	..
,,	27	..	6	..	..
March	5	7	..	..	..
,,	26	..	6	..	..
April	2	8	..	..	..
May	7	6	..	..	..
June	4	6	..	..	..
,,	6	..	5	..	..
July	3	..	..	6	..
,,	18	..	..	6	..
September	27	..	..	5	..
October	1	6	..	..	4
,,	9	..	3	5	..
,,	16	..	..	..	5
November	5	9	..	..	..
,,	12	..	5	..	..
December	3	7	..	6	..
,,	31	6	6	..	..
Totals		62	39	28	9
Average		6·9	4·9	5·6	4·5
No. of Members		9	7	7	5

Every one of the Society's stations† has been inspected by the Assistant-Secretary, and found in a fairly satisfactory condition. The observers have in all cases accepted his suggestions as to improvements in the position of the instruments, or in the method of observing. It was found that the observers differed considerably in their estimation of the wind force, which, in the opinion of the Assistant-Secretary, was generally under-estimated. As regards the barometer, in two instances, the observers had been accustomed to set the index by bringing the lower edge to the base of the meniscus of the mercury, instead of making it tangential to the summit, the readings being consequently too low. The thermometers were not always placed 4 feet from the ground, and in some instances were so mounted that the indices of the self-registering instruments were liable to displacement by being shaken. Errors to the extent of 7°·0 in the readings of the spirit minimum thermometers were in two cases traced to this cause during a gale of wind, the indices having crept along the tube when not horizontal. Another source of error has escaped the attention of some of the observers, arising from the alcohol in the thermometers exposed on the grass vaporising and then condensing at the extremity of the tube; and the thermometers have not unfrequently been hidden in the grass, instead of resting on it, with as free an exposure as possible.

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* The Editing Committee has not met during the year, its work being carried on by correspondence.

† *Vide* Plate XXII.

At all the stations the observers and their deputies were requested to go through a complete set of observations. With a view to accuracy and uniformity, it is recommended that observers should frequently let their deputies take the observations under their immediate inspection, as the latter are otherwise liable to get out of practice.

The Stations inspected were:—

Audley End
Babbacombe
Buxton
Carmarthen
Caterham
Cheadle
Cheltenham
Chester
Churchstoke
Dartmoor
Downside
Eastbourne
Gainford
Hereford
Hillington
Kelstern
Llandudno
Lowestoft
Mansfield
Marlborough
Ramsgate
Scaleby
Shrewsbury
Strathfield Turgiss
Wakefield

The Council wish to express their gratification at the result of the inspection, and their sense of the devotion and self-denial of the observers in carrying out such continuous and arduous work.

The names printed in italics in the above list are those of the new Stations, which are well situated for recording the meteorology of parts of the country hitherto unrepresented in our publications. Particulars relating to them are given in Appendix I.; and a detailed report by the Assistant-Secretary on all the Stations is preserved for reference. The observations at Hawes, one of the Society's Stations from which copies of the observations were furnished to the Meteorological Office, were discontinued in December, 1877. To supply the deficiency the Meteorological Council have accepted the returns from Llandudno.

The Council have determined to discontinue from the year 1877, the publication in detail of the observations from two of their stations in the Quarterly Journal, viz. Hawes and Strathfield Turgiss, which had been originally selected to represent the climate of the north and south of England respectively. But as Hawes is no longer an observing station, it has not been thought necessary to print in the Society's Journal the daily observations from Strathfield Turgiss, especially as they will still appear in the Quarterly Weather Reports of the Meteorological Office.

The annual tables of results from certain stations will also be discontinued, having been superseded by the publication in the Journal of the monthly schedules, which appear with much greater promptitude than was possible in the case of annual tables.

The attention of the Council has been specially attracted, during the severe frost of the present winter, to the unsatisfactory state of the hygrometrical observations at many of the stations, owing to the difficulty of managing the wet bulb thermometer when the temperature is below the freezing point. They would venture to draw the attention of observers and physicists to the subject, in the hope that some method of taking hygrometrical observations may be devised which is not liable to failure during frost.

Various observations having been reported from the Society's stations which cannot be inserted in the published monthly tables, the Council have considered in what way they can best render them generally available for study. As regards terrestrial radiation, they think it undesirable to publish results until thermometers of identical pattern are used, and uniformity in their management and exposure secured. A pair of solar radiation thermometers, black and bright bulb *in vacuo*, is provided at several of the stations, and it has been resolved to continue the discussion of the records commenced by the Rev. F. W. Stow in 1869.*

The Meteorological Council have contributed £110 to the funds of the Society, in return for copies of the monthly reports from fourteen, for yearly abstracts from two, and for weekly records of the maximum and minimum temperatures and rainfall from six stations. These with other reports are published for the benefit of agriculturists every Thursday. The Meteorological Council have also very liberally allowed the Society £25 towards the expense of inspecting its stations.

The work of the Society has been largely augmented by the establishment of the eight new stations, involving a great increase of labour in the reductions of the observations. The Assistant-Secretary (who was frequently accompanied by the President, and had the benefit of his advice) was also occupied for nearly a month in the tour of inspection. As the Council do not desire to undertake any work which they are unable effectually to supervise, a second computer was engaged at the beginning of the year, and the measure has been attended with success. Rather than forego the opportunity of establishing the new stations in localities where they were much wanted, the Council were prepared to defray the attendant expenditure by a special subscription, but this has not been found necessary.

One of the proofs of the vitality of a scientific society, not less significant than its increase in members, is afforded by the character of the communications read at the meetings. Gauged by this test, the pages of the Quarterly Journal afford conclusive evidence of the satisfactory position attained by the Society. Several of the more important papers have led to interesting discussions, which have been promoted by printing copies in advance for perusal by the Fellows. The Quarterly Journal has been enlarged by printing the monthly tables of abstracts of the meteorological observations made at the Society's stations, and a summary of the weather for each quarter. This information is further supplemented and illustrated by symbols representing daily occasional phenomena, including rain, hail, snow, fog, thunderstorms, and halos. Types for printing the symbols have been prepared specially for the Society, and are those adopted by the International Congress. The results have been arranged in a tabular form, so as to show at a glance the general character of the weather at the several stations. To meet the inconvenience resulting from the increased size of the volume, it has been decided to issue the Journal in annual instead of biennial volumes, which for the future will be published by Mr. Stanford, of Charing Cross.

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* *Vide* Quarterly Journal of the Meteorological Society, vol. II., page 205.

The Society is again indebted to the Rev. T. A. Preston for his interesting report on the phenological observations of the past year. In the hope of ultimately being able to trace the effects of heat, rainfall, and other meteorological elements on the growth of crops and vegetation generally, the Council, propose, as a commencement, to publish such observations of the temperature of the soil as may from time to time become available. They have issued circulars to the members of the Royal Agricultural Society soliciting their co-operation and support, in the belief that they will thus obtain efficient aid from a body of men who have large experience, and are well qualified to assist in this branch of inquiry.

Although the action taken by the Lightning Rod Committee is not strictly a work of this Society exclusively, yet, as the Conference was inaugurated through its agency, the Council may be permitted to state that inquiries have been addressed to the principal manufacturers of Lightning Conductors, as to their practice on several specified points in the making and fixing of conductors; and that information is being sought respecting houses provided with conductors which have been struck by lightning.

When the question of the future inspection of the stations was under consideration, it was determined to appeal to the Fellows for subscriptions [illegible] a limited amount for a testimonial to Mr. Symons, who had hitherto, so far as he was able, performed this work gratuitously for the Society. The appeal was responded to by 200 Fellows, who have subscribed nearly £60 which sum has been expended in the purchase, binding, and illumination [illegible] an Album containing the photographic portraits of the subscribers. The Album, which is a very fine work of art, bears the following inscription:—

"Presented by a large number of Fellows of the Meteorological Society to GEORGE JAMES SYMONS, F.R.S., Member of Council and Chairman of the Exhibition Committee of the Royal Botanic Society, Member of Council of the French Meteorological Society, &c., in friendly recognition of the valuable work done by him for the Society by inspecting its stations and testing the instruments used by the observers, independently of the services rendered by him as one of the Secretaries for several years."

The Society has to deplore the loss by death of two Honorary Members, and of seventeen Fellows, whose names, with the dates of their election into the Society, are as follows:—

Honorary Members:—Professor Henri Victor Regnault (June 18, 1862); and Padre Angelo Secchi (June 17, 1874).

Fellows:—James Whatman Bosanquet, F.R.A.S. (June 18, 1862); John Bravender, F.G.S. (April 19, 1876); John Brown (May 17, 1876); Rev. Joseph Crompton, M.A. (January 19, 1870); John Curtis (June 18, 1862); William Philip Dymond (May 7, 1850); Arthur S. Hobson, F.C.S. (November 18, 1868); Henry Johnson, F.R.A.S. (January 16, 1861); Dale Knapping (November 25, 1851); A. H. Leycester (November 17, 1875); Sir John Powlett Orde, Bart. (March 19, 1862); Henry Pearde, M.D. (November 18, 1874); George Granado Graham Foster Pigott, F.R.A.S. (June 17, 1863); Benjamin Thomas, L.R.C.P. (June 21, 1876); George Venables Vernon, F.R.A.S. (May 4, 1850); Sir Frederick Martin Williams, Bart., M P. (February 20, 1867); and Thomas Barber Wright (November 12, 1850).

The roll of the Society has also been further diminished by 5 resignations and the removal of 9 defaulters, making, with the deaths (3 of which occurred previous to December 31, 1877), a total loss of 33, against 41 Fellows elected in 1878.

Fellows.	Life.	Ordinary.	Honorary.	Totals.
1877, December 31 ...	89	312	16	417
Since elected	3	34	4	41
Deceased	7	10	2	19
Retired	...	5	...	5
Defaulters	...	9	...	9
1878, December 31 ...	85	342	18	425

The following figures show the position of the Society for each year since it procured a Charter of Incorporation in 1866:—

1866 June......	331	1873 December......	308
1867 „	328	1874 „	327
1868 „	330	1875 „	358
1869 „	341	1876 „	398
1870 „	340	1877 „	417
1871 „	314	1878 „	425
1872 „	309		

The total income for the year amounted to £618 2s. 4d.; the total expenditure to £628 17s. 1d. The Balance Sheet (Appendix V.) shows (besides the ordinary payments) several large items of expenditure which are not likely to recur for several years. Thus, a sum of £17 8s. 9d. has been spent on standard instruments for testing those used by the Society's observers, and about £30 for inspecting the Stations, in excess of the probable future annual charge. A barometer has also been purchased. The special type for the symbols in the Weather Reports cost £10 6s. 9d.; and there has been an unusually large expenditure in the issue of circulars of a character likely to prove reproductive. On these grounds the Council consider that the resources of the Society have not been unduly strained.

APPENDIX I.

REPORT OF THE ASSISTANT-SECRETARY ON THE INSPECTION OF THE STATIONS. (Plates XXII.-XXIV.)

CHELTENHAM, *May 29th.*—Mr. R. Tyrer, on his removal from Mansfield to Cheltenham at the beginning of the year, undertook to equip a second order station; he procured a new set of instruments, and commenced observing on February 1st. The instruments are placed on an open lawn fully exposed. There is a large pond some distance to the NNW. The country is level to the foot of the Cotswold Hills, about 2 miles to the E. Several suggestions were made as to the mounting, &c., of the instruments, and the observations will now be comparable with those from the other stations.

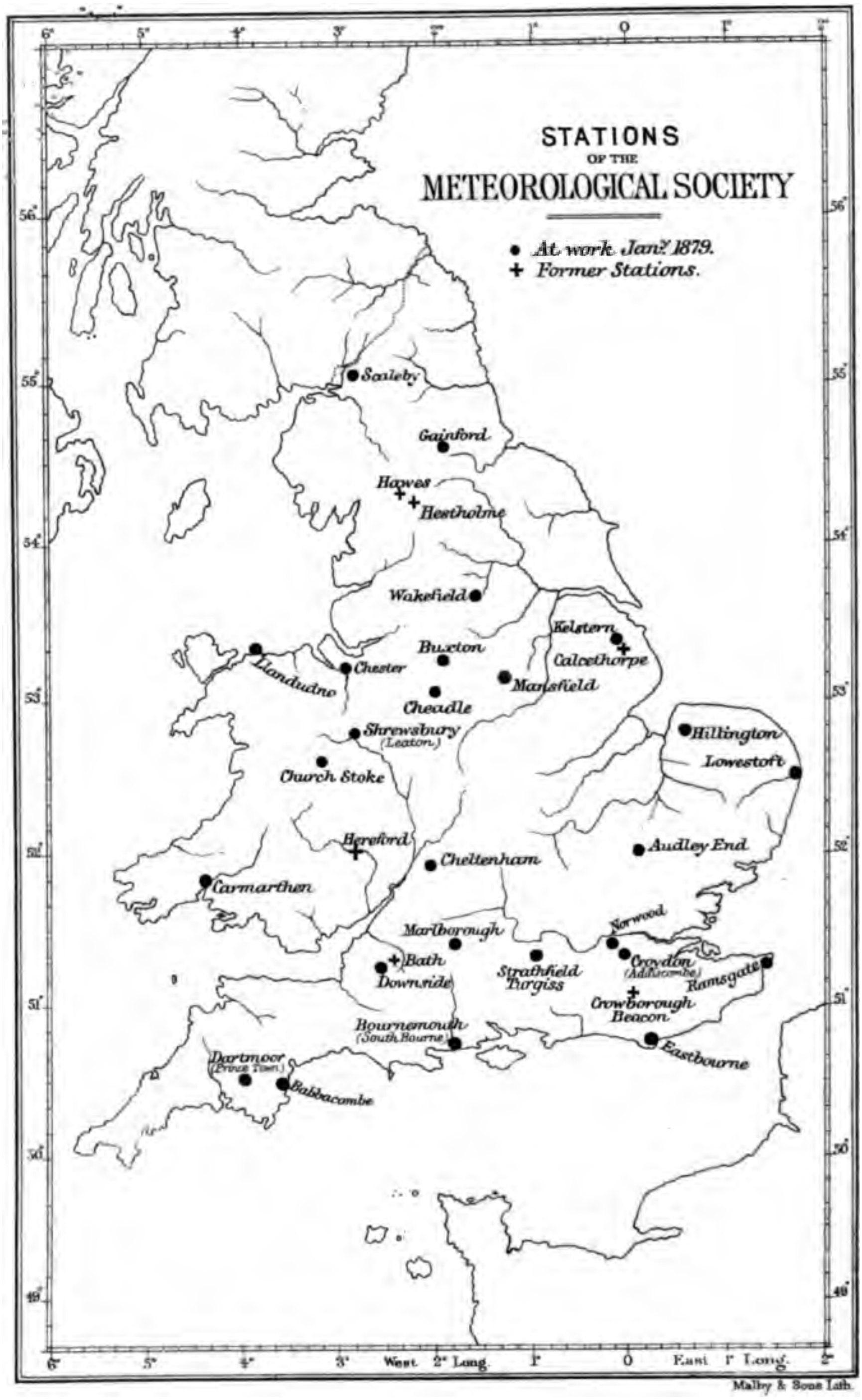
CHESTER, *April 27th.*—When it was decided to increase the number of stations and publish the observations quarterly, Mr. Walker willingly undertook to supply observations for Chester, and purchased a Kew barometer to complete the necessary equipment of his station. The instruments are in a large fruit and vegetable garden attached to the Lead Works, joining the south side of the railway station, in a good position; but they are exposed to the smoke from the locomotive engines and chimneys. The observations are taken by the head gardener, King.

DOWNSIDE, *May 28th.*—This station is at St. Gregory's College, on the summit of the Mendip Hills, and on the old Fosse Way, about 12 miles S of Bath, and 8 miles ENE of Wells. Observations were taken here from 1862 by the Rev. W. Snow, but all the instruments were destroyed by the fire which occurred at the monastery some years ago. At the instance of the Revs. E. J. Stutter and T. H. Quelch, who were both formerly at Ramsgate, a complete set of new instruments was procured at the beginning of the year, and the observations recommenced on February 1st. The instrument are placed at the N end of a large open lawn, which will be enclosed within the quadrangle formed by the monastery church and buildings when completed. The observations are taken by the Rev. T. L. Almond, assisted by the Revs. J. Gasquet and C. Kengelbacker.

EASTBOURNE, *April 18th.*—The garden in which the instruments are exposed is confined, and is surrounded by walls 7 feet high. On the south a chapel rises to the height of 80 feet. The thermometer stand is in the shade for a great part of the year; but the instruments are in the best position available.

GAINFORD, *August 17th.*—This station is 8 miles W of Darlington, and about 200 yards NNE of the river Tees. The district is nearly level and 280 feet above sea level. The instruments are placed in an open vegetable

Quart. Journ. Met. Soc. Vol. V, Pl. XX



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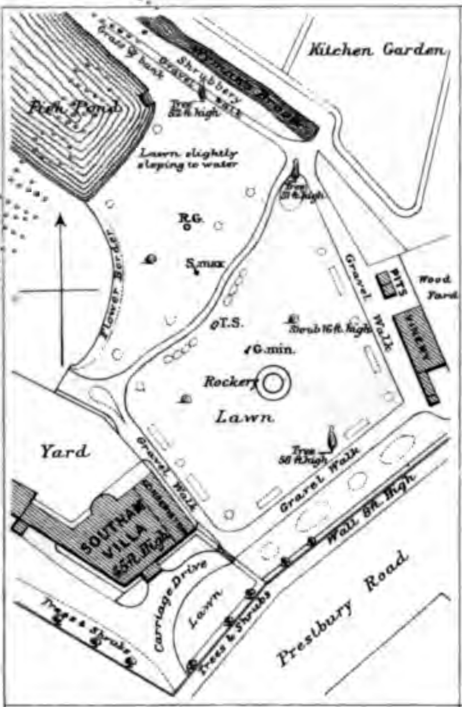
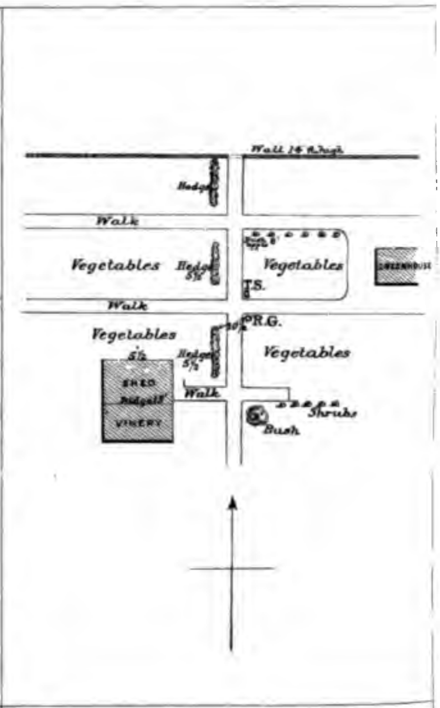
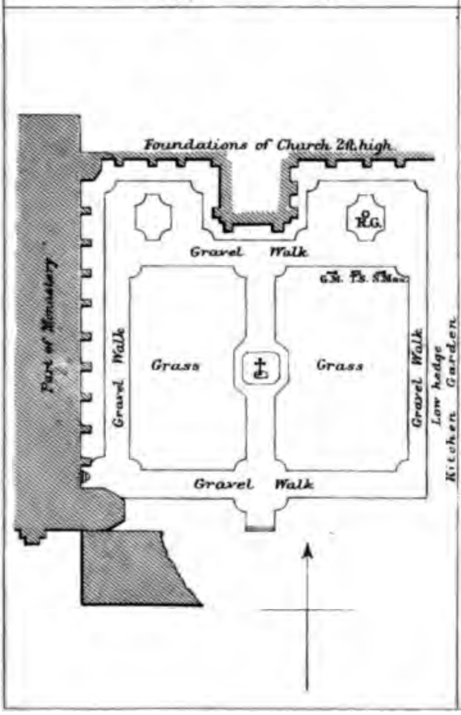
Quart. Journ. Met. Soc. Vol. V Pl. XXIII

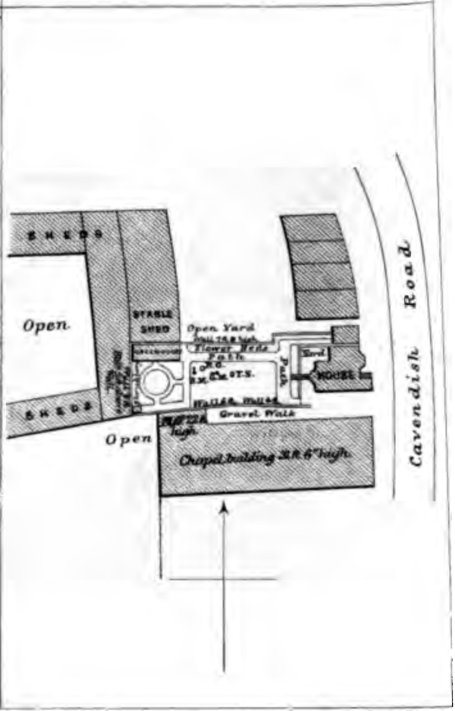
CHELTENHAM.



CHESTER.







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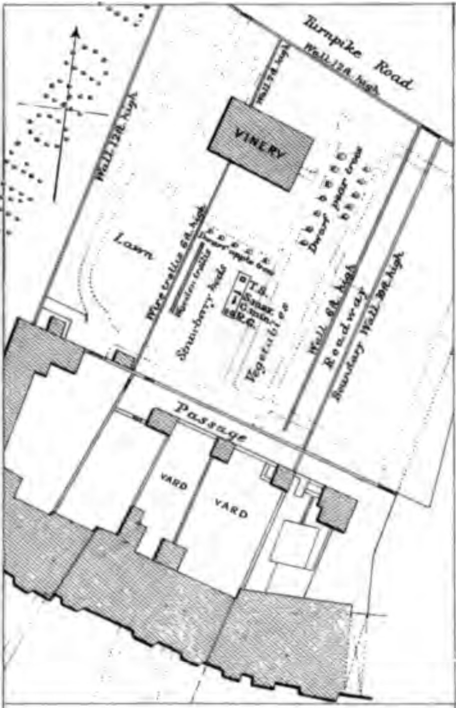
DOWNSIDE.

SCALE.

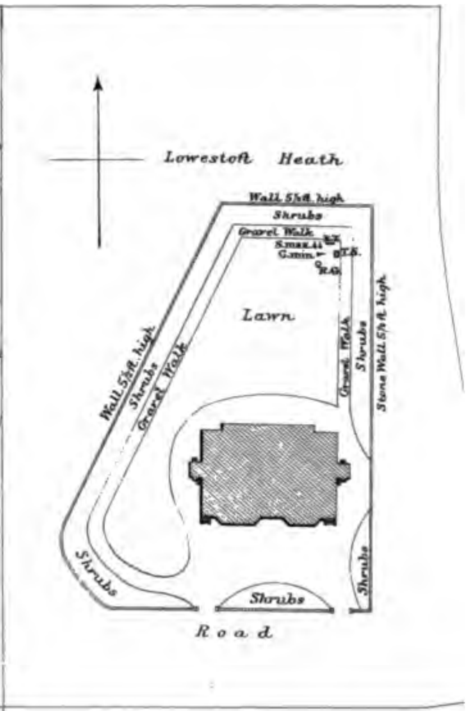
0 40 80 Feet

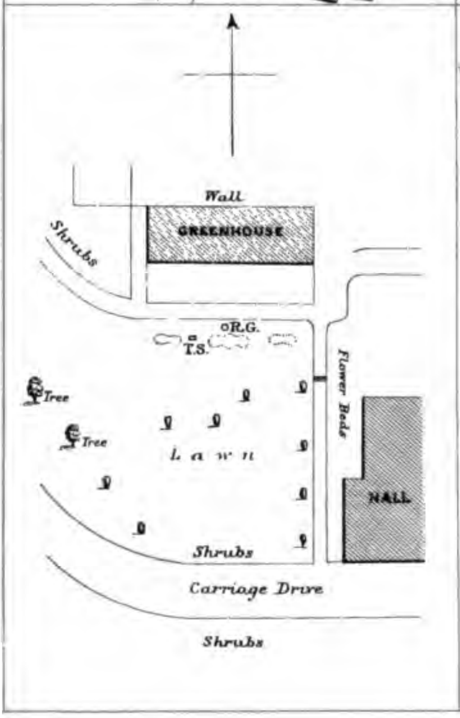
EASTBOURNE.

GAINFORD.



LOWESTOFT.





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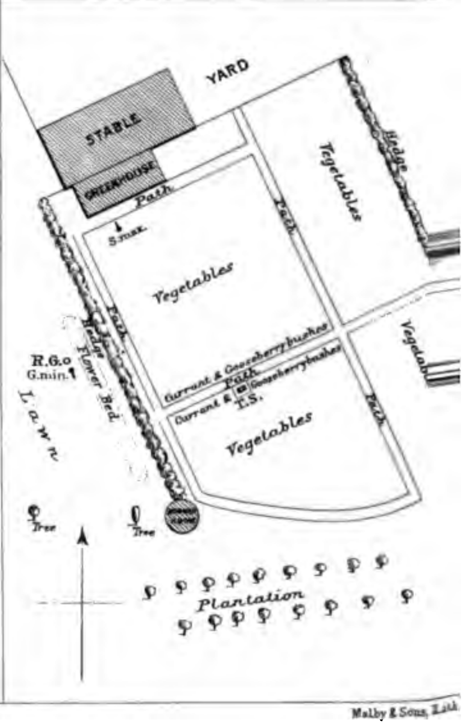

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SHREWSBURY.

SCALE.

0 40 80 feet

garden. The thermometer stand was found to be too close to the fruit trees; and a more favourable site was therefore selected, which Mr. Atkinson undertook to cover with grass. The instruments were removed to the new position in September.

LOWESTOFT, *April 6th.*—Mr. S. H. Miller, on his removal from Wisbech to Lowestoft, offered fully to equip a second-order station for the Society. This offer was accepted. The garden in which the instruments are placed is at the southern end of Lowestoft Heath, and north of Belle Vue pleasure park; it is level, very exposed, and about ⅓ mile from the North Sea and 200 yards from the edge of the cliff. The instruments are in a satisfactory condition.

SCALEBY, *August 17th.*—It being considered desirable to have a station in the extreme N of England, Mr. Allison of Scaleby Hall, 6 miles NE of Carlisle, was applied to, and agreed to establish one and commence observations by January 1st, 1879. This place was visited on August 17th, and a site in the pleasure grounds selected for the instruments. The district is open and nearly level. A detailed examination of the instruments could not be made, as several new ones had to be obtained.

SHREWSBURY, *April 30th.*—This station is at Leaton, 4 miles WNW of Shrewsbury, and about ½ mile from the river Severn. The ground is nearly level for some distance all round, and then slopes slightly upwards. The thermometer stand is in a good position in a vegetable garden with mould beneath it, which will be replaced by a small plot of grass. The rain gauge is on the lawn about 15 feet from a hedge separating the lawn from the garden, and is clear of surrounding objects. To the south of the grounds there are three or four rows of trees, forming a small plantation, but they do not appear to affect the readings. The instruments were all in good condition, and the station a very desirable one. Mr. Pigott has no reliable deputy, and hence during his absence omissions occur which unfortunately break the continuity of the observations.

APPENDIX II.

OBITUARY NOTICES OF DECEASED FELLOWS.

WILLIAM PHILIP DYMOND, third son of Robert Dymond, was born at Exeter, on the 4th of January, 1829. He received his education first at Kimberly House School, Falmouth, then conducted by Lovel Squire, superintendent of the Meteorological Observatory at Falmouth, and afterwards at Grove House School, Tottenham, then under the management of Thomas Binns. At this school, with the advice and assistance of Luke Howard, a small meteorological observatory had been established. The observing and registering of the instruments there was committed to a selected number of the boys, of whom Mr. Dymond was one, and this laid the foundation of an interest in meteorological investigations which, although the exigencies of a busy professional life prohibited the devotion of much time to the subject, was never extinguished. He was one of the earlier members of the Society, having been elected on the 7th of May, 1850, and for several years, during his residence in London, filled the offices of Foreign Secretary and Librarian. He was a member of the Council from 1851 to 1866, and a Vice-President in 1866 and 1867. In the latter year he removed to Falmouth, and became Meteorological Secretary of the Royal Cornwall Polytechnic Society. In this capacity he prepared the meteorological tables and diagrams published with their Annual Reports. In 1871 he set on foot a series of observations on sea temperature, the results of the first three years of which were published with the Royal Cornwall Polytechnic Society's Report for 1874. This paper, together with some remarks on the mean hourly movement of the air at Falmouth, and the results of an inquiry into the general applicability of Glaisher's Diurnal Range Tables for correction of temperature, was also published separately. In it Mr. Dymond showed that "the corrections which are accurate for Greenwich are not accurate for places with a more equable climate," and that "the uncorrected simple arithmetical mean of the daily maximum and minimum readings is as close an approximation to the mean temperature of the whole year as it is practicable under ordinary circumstances to obtain." The observations on sea temperature were conducted by him up to the time of his death, and are, it is believed, still continued. He died at Clifton on the 23rd of March, 1878.

George Venables Vernon was the only son of John Venables Vernon, of the firm of Vernon and Edge, engravers to calico printers at Manchester. He was born on the 7th of October, 1831. He received a good education, and began scientific pursuits at an early age. He was elected a Fellow of the Meteorological Society on the 7th of May, 1850; and subsequently a Fellow of the Royal Astronomical Society. On the 30th of April, 1861, he was elected a Member of the Literary and Philosophical Society of Manchester, and contributed to it many valuable papers and communications. These papers were chiefly on meteorological subjects. His contributions on the Mean Direction of the Wind at Manchester, and on the Mean Amount of Rainfall, are especially useful and instructive. He served as a Member of the Council of that Society, and was for several years Honorary Secretary of its Physical and Mathematical Section. He was a Fellow of the Anthropological Society, and a Member of the Meteorological Society of Scotland, and of the Meteorological Society of France. In private life Mr. Vernon was genial, kind-hearted, and always ready to aid in the pursuit of any science in which he could be of use. He was very fond of microscopic investigations, and a lover of music and other accomplishments. He died on the 11th of January, 1878, at the age of 46 years.

Sir Frederick Martin Williams, Bart., M.P., was born in January, 1830, and was educated at Winchester. In 1858 he married Mary Christian, daughter of the Rev. Robert V. Law, Rector of Christian-Malford, Wiltshire, and grand-daughter of a former Bishop of Bath and Wells. His father achieved a distinguished position as a merchant prince in Cornwall, to which he succeeded in 1870. Sir Frederick represented Truro in the Conservative interest from 1865 to the time of his death. He was elected a Fellow of the Meteorological Society on the 20th of February, 1867. In 1870 he contributed a paper, on the Subterranean Temperature in the Clifford Amalgamated Mines, to the Royal Institution of Cornwall; and in 1877-78 was President of the Royal Cornwall Agricultural Society. He died suddenly of apoplexy on the 3rd of September, 1878, while on a shooting expedition at his North Devon Seat, Heanton Punchardon.

Henri Victor Regnault was born at Aix-la-Chapelle on the 21st of July, 1810, and entered the Ecole Polytechnique in 1830. After remaining there two years, he passed into the Ecole des Mines. In 1840 he was appointed Professor of Chemistry at the Ecole Polytechnique, and had the honour in the same year of being elected Member of the Institute in the section of Chemistry. The following year he became Professor of Physics at the Collége de France, and afterwards Engineer in Chief of the Government Mines, and Director of the Porcelain Manufactory at Sèvres. In 1852 he was placed on the list of foreign members of the Royal Society, and was the recipient of the Rumford Medal in 1848, and of the Copley Medal in 1869. He was one of the earlier honorary members of the Meteorological Society, having been elected in 1862.

Regnault was gifted with a rare penetration of mind, and was surpassed by few in delicacy of manipulation. He was not a theorist, but excelled in devising and in perseveringly applying the best instruments for physical research. His reinvestigation of the fundamental data on which the theory of heat is built up, prepared the way surely for the great discovery of the mechanical equivalent of heat. His papers on the specific heat of compound and simple bodies, and the accurate determination of many of the most important numerical constants in physical science, give Regnault a high rank among experimental physicists; and he merits the gratitude of meteorologists for his researches connected with the elastic force of vapour and of latent heat, with the coefficient of expansion, and other valuable papers on the measure of temperature, and on hygrometry in the 'Annales de Chimie et de Physique,' and in the 'Mémoires de l'Académie des Sciences.'

The losses suffered in consequence of the German war made the last few years of his life a succession of the severest trials. He expired on the 19th of January, 1878.

Angelo Secchi, scarcely better known as an astronomer than as a meteorologist, was born at Reggio, a town situated about half-way between Parma and Modena. He received the elements of his education at the College of the Jesuits in his native town, and joined this religious order on the 3rd of November, 1833, at the early age of 15 years. He afterwards continued his studies of literature and philosophy at the Collegio Romano, and was made

Professor of Natural Philosophy at the College of Loretto in 1840. His course of theological studies was interrupted by the Italian Revolution, and he was in consequence ordained at Stonyhurst, where he first acquired his taste for meteorology and astronomy. He then paid a visit to America, and for some time assisted Father Curley, Director of the Georgetown Observatory. Recalled to Rome in 1849, he was appointed successor to Father De Vico, who had died in London the preceding year. Thus placed at the head of the well-known observatory of the Collegio Romano, he determined at once to carry out the design of Boscovich of erecting a building for the observatory on the unused pillars of the dome of the Church of St. Ignatius. The new observatory was opened in 1853, and the series of observations in astronomy, meteorology, and terrestrial magnetism were commenced, or again taken up, which have been continued unbroken to the present time.

The most striking features in the brilliant scientific career of Father Secchi, were his intense activity and versatility, combined with an inventive genius of no mean order. Ample evidence of this may be found in the 658 papers on various scientific subjects from the pen of this indefatigable worker, 74 of which are on meteorological questions. His astronomical work lay chiefly in the field of celestial physics, and the results contained in his two latest works on the sun and on the spectra of the stars will be a lasting monument of his untiring labours. Besides rebuilding the observatory of the Collegio Romano, Secchi founded the elevated observatory of Montecavo, and another at Grotta Ferrata in Latium; and he was of the greatest service in promoting the 'Correspondenza Meteorologica Alpina-Appennina.' Among his meteorological papers, the most numerous are those on the connection between meteorological and magnetic phenomena; the ideas contained in his book on the Unity of the Physical Forces being ever uppermost in his mind. It was at the instance of Father Secchi that telegraphy was first applied *systematically* to meteorology, and in 1856 storm signals between Rome, Ancona, Bologna and Ferrara were established by the Pontifical Government. This important statement is contained in our Quarterly Journal, Vol. IV., p. 212. He also aided the Italian Government in arranging the meteorological service of Italy, and at the time of his death, on the 26th of February, 1878, he was still President of the Directive Council of Italian Meteorology. Secchi was elected foreign member of the Royal Society in 1856, and of the Meteorological Society in 1874.

APPENDIX III.

List of Books Purchased.

Academie del Cimento, Essays of Natural Experiments made in the Translated by R. Waller, F.R.S. (1684).

Argelander, Prof. F. W. A.—Verzeichniss von Nordlichtern beobachtet auf den Sternwarten zu Abo und Helsingfors in den Jahren 1823-37 (1866).

August, Dr. E. F.—Ueber die Fortschritte der Hygrometrie in der neuesten. Zeit

Birt, W. R.—Handbook of the Law of Storms (1853).

Buchan, A.—Handy Book of Meteorology. First Edition (1867).

Chambers, Dr. T. K.—Some Effects of the Climate of Italy (1865).

Daniell, Prof. J. F., F.R.S.—Elements of Meteorology. Third Edition. Two Vols. (1845).

Dove, Dr. H. W.—The Distribution of Heat over the surface of the Globe (1853).

————.—Untersuchungen im Gebiete der Inductions-electricität (1843).

Fleming, Rev. Dr. J.—The Temperature of the Seasons (1851).

Forbes, J. D., F.R.S.—Report upon the recent progress and present state of Meteorology. Second Edition (1835).

France.—Annuaire Météorologique. Tome II. (1850).

Howard, Luke, F.R.S.—A Cycle of Eighteen Years in the Seasons of Great Britain (1842).

Jevons, W. S.—On the deficiency of Rain in an elevated Rain-Gauge, as caused by Wind (1861).

Kaemtz, Prof. L. F.—A Complete Course of Meteorology. Translated by C. V. Walker, F.R.S. (1845).

Lardner, Dr. D., F.R.S., and Walker, C. V., F.R.S—A Manual of Electricity, Magnetism and Meteorology. Two Vols. (1844).

Lowe, E. J., F.R.S.—A Treatise on Atmospheric Phenomena (1846).

Maps of the Society for the Diffusion of Useful Knowledge. Two Vols. (1846).

Martin, F. P. B.—A Memoir on the Equinoctial Storms of March-April, 1850 (1852).

Martins, C.—Sur l'Accroissement Nocturne de la Température avec la Hauteur, dans les couches inférieures de l'Atmosphère (1861).

Merryweather, Dr. G.—An Essay explanatory of the Tempest Prognosticator in the Exhibition (1851).

Miller, J. F., F.R.S.—On the relation of the Air and Evaporation Temperatures to the Temperature of the Dew-Point (1851).

Peltier, A.—Observations et Recherches expérimentales sur les causes qui concourent à la formation des Trombes (1840).

Philips' Handy Atlas of the Counties of England (1877).

Redfield, W. C.—On three several Hurricanes of the Atlantic, and their relations to the "Northers" of Mexico and Central America (1846).

Report of the Committee of the House of Commons on Ventilation, Warming and Transmission of Sound. With Notes by W. S. Inman (1836).

Signer, Dr. J. A.—Novum Barometrum Navale (1743).

Shepherd, G.—The Climate of England (1861).

Stratingh, Dr. G. A.—De Aquae Vapore in Atmosphaera Contento (1824).

Thomson, Dr. S.—Health Resorts of Britain; and how to profit by them (1860).

"Times" Register of Events in 1877.

Winckler, Dr. C. L. G.—Tafeln zur Berechnung der Höhen aus beobachteten Baro-und-Thermometer-Ständen, nebst den briggsschen Logarithmen aller natürlichen Zahlen von 1 bis 10,000 (1826).

————.—Tafel, um Hygrometerstände, die bei verschiedenen Wärme-Graden beobachtet worden sind, auf beliebige Normal-Temperaturen zu reduciren (1826).

APPENDIX IV.

Reports of Observatories, &c.

The Meteorological Office. Professor H. J. S. Smith, M.A., F.R.S. Chairman of the Council; Robert H. Scott, M.A., F.R.S., Secretary.—The operations of the office have not presented many features of variety as compared with preceding years.

Marine Meteorology.—In the department of Ocean Meteorology the time of the staff has been mainly taken up in the extraction from the logs of the information available for the district lying about the Cape of Good Hope. The Council have not, however, as yet, finally decided on the precise lines on which the discussion shall be effected.

The Indian Government has applied for a copy of all the observations existing in the Office for the Northern Indian Ocean, and these are in process of being extracted, so that the stores of material collected during the last 25 years are being rendered accessible to other Offices besides our own.

The Atlas of Synoptic Charts for August, 1873, with a volume of accompanying Remarks, the work of Captain Toynbee, has been published.

Weather Telegraphy.—The only change of consequence in the system of collection of Reports has been the establishment of a station at Mullaghmore on the Southern Shore of Donegal Bay. This is a most important addition to the telegraphic network of Europe, for the only station in the North-west of Ireland previously available was Greencastle, which was sheltered from southerly and westerly winds by the high land of Innishowen. The Sunday service has been maintained regularly, and the arrangements with the 'Times' for the supply of evening intelligence to that journal has continued to work satisfactorily.

The Council in February commenced the publication of a Weekly Weather Report. This is published by Mr. Potter (Poultry), and Mr. Stanford (Charing Cross), at an annual subscription of 12s. 6d., post free, and is not issued by the Office to subscribers like the lithographed Daily Weather Report. The object of the Weekly Weather Report is to show the temperature and the rainfall of the several districts of the United Kingdom. Of these districts ten are represented on the form published in the newspapers, embracing in a general way the surface of the British Isles with the exception of the Highlands of Scotland. The stations in each district which furnish the returns are pretty uniformly distributed over England and part of Scotland, but from Ireland additional information is most desirable. The Council have to express their sincere thanks to the Meteorological Society for supplying, at a nominal cost, weekly returns from six of its stations for the purpose of this Report. The first page of the Weekly Weather Report is intended for republication in the newspapers, and only aims at an accuracy of whole degrees for the temperature and of tenths of an inch for rain. This appears to be amply sufficient, considering the small number of stations taken to represent each district. Detailed tables for the individual stations give the average temperature to tenths of a degree, and the rainfall to hundredths of an inch; and the report contains a short account of the weather for each day, illustrated by charts on a small scale, of pressure, temperature, wind, state of the sky, and rain.

Land Meteorology.—There are no changes of importance in connection with the seven observatories. The volume of the Quarterly Weather Reports for 1875 has been completed, and it contains the means for the observations for the Lustrum 1871-75, and for the telegraphic stations, means of pressure, temperature and rainfall for the same period, and at some other stations, for the ten years 1866-75. The returns are being printed for the year 1878 from a greater number of Stations of the Second Order. Thus Observations and Monthly Summaries relating to 25 stations will be printed for 1878, as compared with 23 printed for 1877. Of Monthly Summaries only the numbers are respectively 10 for 1878, as against 9 for 1877. The Council have decided to order one of the Harmonic Analysers, invented by Sir W. Thomson, in conjunction with his brother Prof. J. Thomson, which will enable them to reduce the constants of Bessel's Formula for each element directly from the photographic curves.

The Annual Report of the Office contains an important supplement by Prof. J. D. Everett, on the results of the experiments on Atmospheric Electricity which have been made at Kew.—*Feb. 12th*, 1879.

ROYAL OBSERVATORY, GREENWICH. Sir G. B. Airy, K.C.B., F.R.S., Astronomer Royal.—The meteorological work of the Observatory is still continued on the same general plan as for many years past, including photographic and automatic registration of pressure, temperature, direction and velocity of wind, and rainfall, record of sunshine, &c., with such eye observations of the same elements as appear necessary.

Some slight alterations and additions have been made to the open thermometer stand, on which are placed the standard dry and wet bulbs, and other thermometers, with the object of more effectually protecting the thermometers exposed thereon from the influence of radiation.

The thermometers for photographic registration of the temperature of the air and evaporation have been replaced during the year by new thermometers having no sensible index error; this does not, however, obviate the necessity of applying corrections (determined by comparison of eye readings of the standard instruments with the corresponding photographic indications) to reduce the photographic values to such as would be obtained by free exposure on the open stand.

The electrometer, on Sir William Thomson's plan, was brought into use in the autumn, and some satisfactory photographs have been secured. The cistern insulators (ebonite pillars) after a time, however, appeared to fail; no indication of electricity being obtained. In the month of October, Messrs. Elliott were in consequence instructed to prepare new insulators, each composed of a glass pillar, encircled by a vessel containing sulphuric acid; these were received in December, and have only recently been brought into use.

The volume containing results derived from the tabulation of the barometer photographs from 1854 to 1873, and of the dry and wet bulb thermometer photographs from 1849 to 1868, and also results of the eye observations of the earth thermometers from 1847 to 1873, has been printed since the date of the last report, and will shortly be distributed.

The daily meteorological results, as regard the pressure and temperature of the air and dew-point, hitherto published in the annual volume, have been those determined from eye observations (taken a few times each day, and corrected for diurnal inequality, &c.), as prepared for the meteorological table furnished weekly to the Registrar General. It is now intended that, commencing with the year 1877, results derived from the photographic records shall be employed, and that the wet-bulb thermometer indications, as well as the dew-point values, shall be included. Also, that the records for the years preceding 1877, not yet tabulated, shall be taken in hand as soon as circumstances permit. In the volume referred to in the preceding paragraph the barometer photographs have been discussed to the year 1873, and the dry and wet-bulb thermometer photographs to 1868. The years from 1874 to 1876 for the barometer, and from 1869 to 1876 for the dry and wet bulb thermometers, therefore yet require to be done.—*Jan.* 25*th*, 1879.

ROYAL OBSERVATORY, EDINBURGH. Professor C. Piazzi Smyth, F.R.S.E., Astronomer Royal for Scotland.—At the Royal Observatory, Edinburgh, there has been the usual computation through the year of the meteorological observations from 55 Scottish stations furnished to the Registrar General, and the condensed results have been printed with that officer's monthly and quarterly returns.

The above is moreover all the Meteorology that any funds are allowed for here by Her Majesty's Government. The Astronomer has, however, been able to contribute to the Journal of the Scottish Meteorological Society a short paper on "Rain-band Spectroscopic Observation at Sea," by his friend Mr. Charles Bell, late Surveyor General at the Cape of Good Hope, in a voyage from England to Table Bay in June and July, 1878.—*Jan. 7th*, 1879.

KEW OBSERVATORY. George M. Whipple, B.Sc., F.R.A.S., Superintendent.—The several self-recording instruments for the continuous registration respectively of pressure, temperature, humidity, wind (direction and velocity), and rain, have been maintained in regular operation throughout the past year. The daily standard eye-observations for the control of the automatic records have been made regularly, as well as daily observations in connection with the Washington synchronous system. The tabulation of the meteorological traces has been regularly carried on, and copies have been transmitted weekly to the Meteorological Office.

In compliance with a request made by the Meteorological Council, the Observatories at Aberdeen, Armagh, Falmouth, Glasgow, Stonyhurst, and Valentia have been visited and their instruments inspected by Mr. Whipple, who has also inspected the telegraph-reporting and climatological stations throughout Ireland.

With the sanction of the Meteorological Council, weekly abstracts of the meteorological results have been regularly forwarded to and published by the 'Times,' 'Illustrated London News,' and 'Mid-Surrey Times.'

The electrograph has been in almost continuous action through the year, and certain improvements in minor details, suggested by Sir W. Thomson, have been introduced from time to time. It has been thought desirable to make a determination of the scale value of the instrument throughout the whole extent of its range. The Committee not possessing a sufficiently powerful battery for the purpose, the electrometer was conveyed to Mr. De La Rue's laboratory, where a complete determination of its scale value was made over the range of tension afforded by 1,200 chloride of silver cells.[*] At the request of Professor Mascart, a typical set of curves, illustrating the action of the electrograph during different kinds of weather, was reduced and engraved by the pantagraph at the Meteorological Office, and forwarded for illustrating his lectures before the Société Météorologique de France. These engravings have since been reproduced, together with notes respecting the instrument, in a report on Atmospheric Electricity, drawn up by Professor Everett, for the Permanent Committee of the Vienna Congress.

The Solar-radiation Thermometers are still observed daily, and a new form of the instrument, designed by Professor G. C. Foster, is undergoing trial. The question of observing Solar-radiation having been referred by the Meteorological Council to the Kew Committee, a sub-committee has been appointed to take the subject into consideration.

The Campbell Sundial continues in action, and the improved form of the instrument, giving a separate record for every day of the duration of sunshine, has been regularly worked throughout the year and its curves tabulated.

A paper comparing the relative amount of sunshine recorded by this instrument during the year 1877, with the amount registered at the Royal Observatory, Greenwich, by a similar apparatus, has been read before this Society.[†] A copy of the Kew instrument, constructed by Mr. Browning for the Brussels Observatory, has been compared at the Observatory; and another instrument, with a new form of mounting, designed by Mr. R. J. Lecky, has also been tried.

The Wind Component Integrator, which at the time of the last Report was working temporarily, attached to the Kew Anemograph, was found to interfere with the regular action of the latter instrument, and accordingly its own cups and vane, sent over by Professor von Oettingen, have been fitted to it. With the exception of a small period, during which it was under repair (one of the cups having been carried away by a high wind), it has been in good action. A comparison of its indications with those of the ordinary instrument will shortly be made.

A Photo-nephoscope, designed by Professor Stokes and Mr. F. Galton for the purpose of photographing clouds at the time of their passage across the zenith, has been the subject of experiment for some time, with a view of its adoption as a means of trigonometrically determining the height of clouds.

The work of the Verification department of the Observatory is still increasing, and its field extending; the makers, who send instruments for examination from places both at home and abroad, are continually becoming more numerous. The total number of instruments of all kinds which have passed through the Observatory during the year was 4,308; and the fees earned amounted to £388 1s. 11d. The Council have recently decided to affix their "Hall mark" to all thermometers verified by them, without any additional fee.

A Hydraulic Press especially constructed for the purpose of subjecting Deep-sea Thermometers to pressures similar to those they experience when sunk to great depths, has been erected in the workshop. It is capable of exerting a strain equal to 4 tons on the square inch. Several protected thermometers have been found to stand this test successfully.

Steps are being taken to obtain a standard Air Thermometer.

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[*] Proceedings of the Royal Society, Vol. XXVII. p. 356.

[†] Quarterly Journal, Vol. IV. p. 201.

In consequence of a communication from Dr. Guthrie as to the presence of cryohydrates in water lowering its freezing point, a series of experiments was made for determining the melting point of distilled-water ice, rain-water ice, clean pond ice, and the commercial ice used at the Observatory. It was found to be practically identical in all the specimens examined, the differences observed only amounting to a few hundredths of a degree Fahrenheit.

The old Royal Society Standard Barometer, with the flint and crown-glass tubes refilled by Negretti and Zambra, has been compared with the Kew standard daily for several months. Its scale has also been measured and its error determined. In addition to the usual tables of magnetic results appended to the published Annual Report of the Kew Committee, Tables of Meteorological Results for the year October, 1877, to September, 1878, have been given with the one recently issued. These tables show, for each month, means and extremes of the thermometer and barometer, means of vapour tension and dry air pressure, amount of cloud, total and extremes of rainfall, also weather, wind, and the amount of sunshine.—*Jan. 6th*, 1879.

STONYHURST OBSERVATORY. Rev. S. J. Perry, M.A., F.R.S.—The meteorological and magnetic work enumerated in last year's report has been carried on uninterruptedly during the past twelve months. The only addition to the routine duties is a weekly report of agricultural statistics of weather drawn up for the Meteorological Office. The magnetograms have all been measured, and the daily and hourly means for each month computed.

In addition to the paper on the Meteorology of Kerguelen, deduced from the Transit of Venus observations of 1874-1875, the observations of Sir J. Ross and Captain Crozier, R.N., at Christmas Harbour, during the months of May, June, and July, 1840, have been prepared for publication, and the meteorological work of the 'Challenger,' during her stay at the same island, is in course of reduction.

During the year the director of the Manilla Observatory paid a visit to Stonyhurst, for the purpose of studying the photographic methods, and examining the instruments, previous to his return to the Philippines, and instruments are now being tested that are shortly to be sent after him.

The mission about to be formed in the South of Central Africa has been supplied with a complete set of the requisite meteorological, magnetic, and topographical instruments. Most of these have been carefully provided by M. A. d'Abbadie, Membre de l'Institut, the well-known Abyssinian traveller, but the chronometer and disc circle have been procured and tested at Stonyhurst.

A thermograph, barograph, and electrograph have also been constructed for Zi-Ka-Wei, under the superintendence of the director of this Observatory. As some of the tubes were broken in their journey to China, others to replace them have been forwarded by a special steamer, thanks to the kindness of the Meteorological Office.—*Jan. 9th*, 1879.

APPEN-

'Abstract of Receipts and Expenditure

Receipts.

	£	s.	d.	£	s.	d.
Balance from last year	....			83	15	5
Dividend on £800 M. S. and L. B. 4½ Debenture Stock	35	9	7			
Do. £212 5s. New 3 per Cents.	6	5	4			
				41	14	11
Meteorological Office—						
Copies of Monthly Returns from 14 Stations	100	0	0			
Do. Annual " 2 "	5	0	0			
Do. Weekly " 6 " and Postage	4	13	1			
Grant towards Inspection Expenses	25	0	0			
				134	13	1
Subscriptions for 1874	2	0	0			
Do. for 1875	4	0	0			
Do. for 1876	18	2	0			
Do. for 1877	41	14	0			
Do. for 1878	250	2	0			
Do. for 1879	6	0	0			
Entrance Fees	87	1	0			
Life Compositions	36	0	0			
				389	19	0
Contributions to Discussion Fund				2	6	0
Contributions towards printing Plates for the Rev. W. C. Ley's paper on Upper Currents	8	8	0			
Contribution by Dr. Marcet towards printing his paper on the Meteorology of Cannes	10	17	0			
				19	5	0
Sale of Publications				30	4	4
				£701	17	9

DIX V.

for the Year ending December 31*st*, 1878.

Expenditure.

	£ s. d.	£ s. d.
ournal—		
Printing Nos. 25—28	103 19 3	
Illustrations	14 13 0	
Author's Copies	10 5 6	
Printing Observations for 1876, 1877 and 1878	37 17 9	
Registrar-General's Reports	6 16 0	
		173 11 6
rinting, &c.—		
General Printing	15 4 0	
List of Fellows	11 5 0	
Circulars, Postage, &c., to Agriculturalists	36 8 1	
Stationery	10 17 3	
Books and Bookbinding	11 4 9	
		84 19 1
laries—		
Assistant-Secretary	135 0 0	
Do. Gratuity	5 5 0	
Computers	53 3 6	
		193 8 6
ffice Expenses, &c.—		
Rent and Housekeeper	28 10 0	
Coals, Furniture and Insurance	7 2 8	
Office Table	5 0 0	
Postage and Receipt Stamps	32 19 3	
Refreshments	11 19 7	
Parcels and Petty Expenses	4 17 9	
Commission on Irish Cheques	0 0 9	
		90 10 0
bservations—		
Inspection of Stations	53 7 6	
Instruments for Inspection	17 8 9	
Barometer for Loan to Observers	5 5 0	
Type for Weather Symbols	10 6 9	
		86 8 0
		628 17 1
lance—		
At Bank of England, December 31st, 1878	66 15 2	
In hands of Assistant-Secretary	6 5 6	
		73 0 8
		£701 17 9

HENRY PERIGAL, *Treasurer.*

xamined with the Vouchers and found correct,

E. G. ALDRIDGE,
ROBT. J. LECKY, } *Auditors.*

January 6*th*, 1879.

APPENDIX V.—*Continued.*

Abstract of Assets and Liabilities on January 1st, 1879.

Liabilities.

	£	s.	d.	£	s.	d.
To Subscriptions for 1879, paid in advance....	6	0	0			
„ Bookbinding	1	11	6			
				7	11	6
„ Excess of Assets over Liabilities				1357	10	10
				£1,365	2	4

Assets.

	£	s.	d.	£	s.	d.
By Society's Money invested in New 3 per Cents., £212 5s., at 95⅛................	201	19	2			
„ Society's Money invested in M. S. and L. R. 4½ Debenture Stock, £800, at 111	888	0	0			
				1089	19	2
„ Subscriptions unpaid	100	10	0			
„ Entrance Fees unpaid	9	0	0			
„ Dividend on £800 M. S. and L. R. 4½ Debenture Stock	17	12	6			
				127	2	6
„ Furniture, Fittings, &c.	30	0	0			
„ Instruments	45	0	0			
				75	0	0
„ Cash in hands of Bank of England........	66	15	2			
„ Do. Assistant-Secretary	6	5	6			
				73	0	8
				£1,365	2	4

E. G. ALDRIDGE, } *Auditors.*
ROBT. J. LECKY, }

6th January, 1879.

VI. *Diurnal Variations of the Barometric Pressure in the British Isles.*

By FREDERICK CHAMBERS, Meteorological Reporter, Bombay.

[Received December 24th, 1878—Read February 19th, 1879.]

THE very interesting communication with which the late President of the Meteorological Society concluded his address at the Annual General Meeting in January, 1878, shows conclusively that, in the British Isles, there is a definite connection between the diurnal range of the thermometer and the difference between the morning and afternoon minima of barometric pressure. Mr. Eaton also points out that the diurnal variations of pressure at different stations tend to follow one of two distinct types, according as the station is situated near the sea or some distance inland.

The object of the present brief notice is to show that these differences of type are due to the superposition, on a *common* type of diurnal variation at all the stations, of a distinct diurnal variation of barometric pressure, such as is required to satisfy the convection current theory which explains the well-known diurnal land and sea breezes. To show this, all that is necessary s to take the differences of the corresponding hourly inequalities of the barometric pressure at pairs of inland and coast stations, and to exhibit these differences in the form of curves, which are then found to closely resemble the curves of diurnal variation of the air temperature. For instance, the barometric variations which differ most are those for the inland station Kew and the coast station Falmouth. Reducing these to local time by the graphic method, and taking differences, we obtain the numbers in column 2 of the table (p. 134).

These numbers are plotted in a curve in the diagram, figure 1, which, in form, is almost exactly like a temperature curve.

Performing the same operation upon the variations for the inland station Armagh and the coast station Valentia, we obtain the numbers in column 3. These are plotted in figure 2, which has essentially the same form as figure 1, viz. that of a temperature curve, but the range is less than in the previous case. The variations at the remaining stations, Aberdeen, Glasgow and Stonyhurst do not offer any great contrasts.

In a paper on the Diurnal Variation of the Wind and Barometric Pressure at Bombay, which is published in the 'Philosophical Transactions' of the Royal Society for 1873, I showed that the form of the curve representing the diurnal variation of the velocity of the land and sea breezes at Bombay is also very approximately that of a temperature curve, and in a paper which will shortly appear in the 'Indian Meteorological Memoirs,' I have shown that the same relation between the diurnal variations of the temperature and of the land and sea breezes holds at Kurrachee also. I have frequently sought for the complementary diurnal variation of the barometric pressure, which, in accordance with the theory of the land and sea breezes, should appear when the differences of the diurnal variations of the barometric

Local Hours.	Falmouth *minus* Kew.	Valentia *minus* Armagh.	Mean of		
			Falmouth and Kew.	Valentia and Armagh.	Se Sta
	In.	In.	In.	In.	
1 a.m.	—0·0046	—0·0041	+0·0017	+0·0009	+0
2 "	— ·0081	— ·0044	— ·0023	— ·0032	—
3 "	— ·0096	— ·0053	— ·0077	— ·0075	—
4 "	— ·0114	— ·0059	— ·0103	— ·0100	—
5 "	— ·0112	— ·0063	— ·0103	— ·0093	—
6 "	— ·0103	— ·0059	— ·0066	— ·0063	—
7 "	— ·0081	— ·0053	— ·0019	— ·0018	—
8 "	— ·0073	— ·0044	+ ·0036	+ ·0031	+
9 "	— ·0032	— ·0028	+ ·0067	+ ·0068	+
10 "	— ·0000	— ·0025	+ ·0099	+ ·0081	+
11 "	+ ·0043	+ ·0016	+ ·0097	+ ·0079	+
Noon	+ ·0061	+ ·0027	+ ·0045	+ ·0044	+
1 p.m.	+ ·0083	+ ·0037	— ·0014	·0000	—
2 "	+ ·0095	+ ·0045	— ·0061	— ·0039	—
3 "	+ ·0097	+ ·0047	— ·0084	— ·0062	—
4 "	+ ·0088	+ ·0056	— ·0085	— ·0066	—
5 "	+ ·0089	+ ·0056	— ·0072	— ·0048	—
6 "	+ ·0069	+ ·0049	— ·0028	— ·0015	—
7 "	+ ·0056	+ ·0040	+ ·0011	+ ·0019	+
8 "	+ ·0029	+ ·0034	+ ·0058	+ ·0051	+
9 "	+ ·0032	+ ·0029	+ ·0090	+ ·0074	+
10 "	+ ·0009	+ ·0011	+ ·0096	+ ·0071	+
11 "	— ·0009	— ·0012	+ ·0075	+ ·0050	+
Midnight ..	—0·0022	—0·0027	+0·0050	+0·0018	+0
1	2	3	4	5	

pressure at coast and inland stations are taken, but hitherto w imperfect success; for in India, where the diurnal variations of meteorological elements are very great, there are other influences such as the diurnal hot winds from the interior, which complicate the In the British Isles, however, where the diurnal hot winds, or anti- tion currents, as they may appropriately be called, are almost* unkn differences between the diurnal variation of pressure at coast an stations are almost exactly of the kind required by the convection theory to account for the land and sea breezes, and it will be intere notice whether the diurnal variations of the wind at coast stations British Isles obey the same laws as in India. For this information await the reduction of the anemograms of the Falmouth and Observatories.

In accordance with the convection current theory, the air which is by the expansion of the atmosphere over the heated land, producing the barometer in the interior, accumulates over the surrounding s

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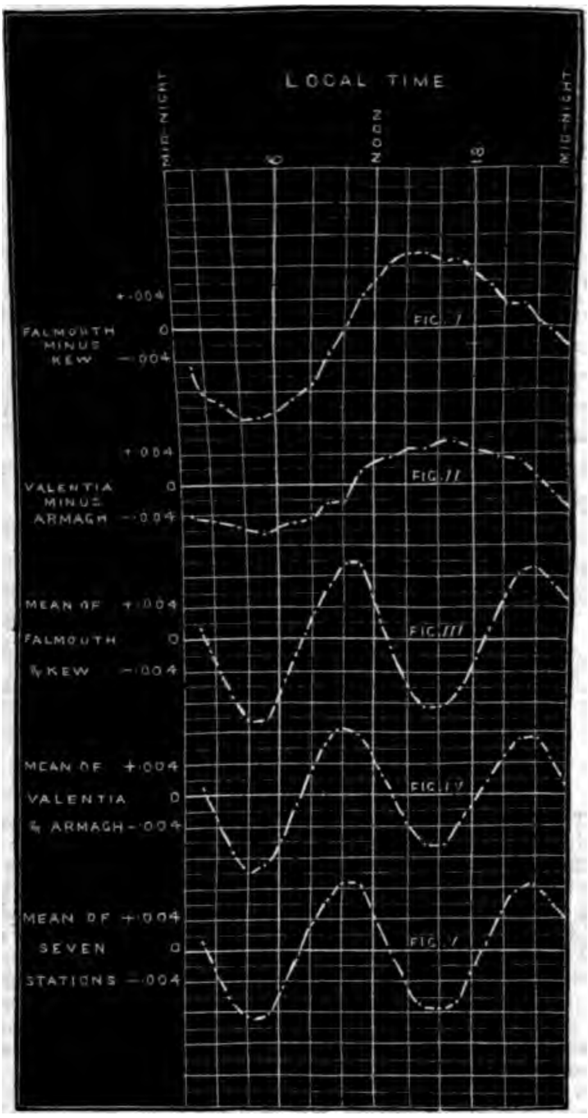
* The Armagh wind results by Dr. Robinson, published in the 'Philosophic sactions' of the Royal Society for 1876, do appear to afford indications of the of very weak diurnal anti-convection currents even in Ireland.



there produces the opposite effect on the barometer, viz. a rise of the mercurial column. If, therefore, we could so choose our stations of observation that these effects on the barometer should be equal and opposite, the mean of the two variations would give the normal diurnal variation of that portion of the globe unaffected by the variations of pressure due to the local systems of diurnal convection currents; and if the local variations of pressure at any two of our stations are opposite in character and *unequal*, the mean of the two variations will be only partially free from the effects, but it will nevertheless approach more nearly to the form of the normal variation of that portion of the globe than either of the separate variations. In columns 4 and 5 of the table are given the means of the Kew and Falmouth, Armagh and Valentia variations, and these numbers are plotted in figures 3 and 4 for comparison with the variations of Aberdeen, Glasgow, and Stonyhurst, exhibited on Plate II. Vol. IV. of the Quarterly Journal of the Meteorological Society.

Although some of the maritime types of variation still characterise figures 3 and 4, they show much better agreement with the Aberdeen, Glasgow, and Stonyhurst curves than any of the individual curves of which they are composed, and the mean of the variations (reduced to local time) at all the seven stations (given in column 6, and represented by figure 5) is probably a near approximation to the normal diurnal variation of that portion of the globe, with but little admixture of purely local effects. We may therefore conclude, that nearly all the differences observable in the diurnal variations of the barometric pressure at different stations in the British Isles are explicable by the ordinary convection current theory, and that the problem of giving a complete explanation of the diurnal variation of the barometric pressure there is reduced to the explanation of the normal variation. With regard to this, I cannot at present advance any thing very material beyond the suggestions given in the paper already quoted, and a brief supplementary note in Vol. XXV. of the Proceedings of the Royal Society; but I believe the discovery and verification of the complete explanation will only be made by more attention being given to the observation and development of the diurnal variations of the wind.

DISCUSSION.

CAPTAIN TOYNBEE said that the best evidence he ever heard as to an upper current of air from land to sea during a sea breeze, was told him by his friend Mr. W. H. Bayley, of the Madras Civil Service. An aeronaut was about to ascend in his balloon from Madras, and waited until a fresh sea breeze had set in, hoping to be driven inland; instead of which, after the balloon had gained a certain height it gave a peculiar twist and moved quickly towards the sea. The aeronaut, not wishing for a sea voyage, allowed some gas to escape, evidently intending to descend into the sea breeze again; in doing this the valve got injured, and the gas escaped so quickly that the balloon fell into the sea, and was picked up by boats about 3 miles from the land. He thought that experiments as to the height and speed of the counter current might be made with small inexpensive balloons.

Mr. EATON observed that Mr. Chambers did not profess to explain by his convection current theory the general law regulating the diurnal range of the barometer. Stated broadly, his communication showed that in the British Isles, in the year 1876, there was an efflux of air during the warmer hours of the day, from places where the diurnal range of temperature was large, to those where the diurnal range of temperature was small; in other words, from inland to maritime stations; a converse action taking place at night. This action was analogous to the grand movements of the atmosphere, as exemplified by the opposite changes of the barometer over oceans and continents, dependent on the time of year.

VII. *On a Standard Cistern Siphon Barometer.* By FREDERICK BOGEN.

[Received December 31st, 1878—Read February 19th, 1879.]

AT the Meeting on June 20th, 1876,* my Patent Travelling Barometer was brought to the notice of the Fellows, and I now beg to submit my Cistern Siphon Barometer, as a standard stationary instrument.

This instrument, though constructed on a similar principle to the former, differs from it in several important particulars. By doing away with the bend of the short glass leg with its glass socket, the grinding of the end of the long leg in the socket is avoided; and no skill is required by the glass blower in making a good fit between the two legs. Thus, the glass work being dispensed with, there is little risk of breakage of the ends.

A permanent position has been given to the disc on the short leg, and a hand with a pointer is fastened to and revolves on the upper end of the screw. Two new stands are exhibited. One is a round board 1 foot in diameter, suspended against the wall, upon which the swinging board with the barometrical tube can be turned to fill the vacuum, and then clamped in any position. The other is an iron stand about 4 feet high, with an arrangement on its upper part similar to that on the board, by which the observer is enabled to turn the tube from the perpendicular to a horizontal position, so as to inspect the Torricellian vacuum minutely.

The tube is easily filled by placing it in a vertical position on the floor, and pouring in the mercury through a short iron funnel covered outside with leather, and provided with a valve.

The accompanying diagram on page 138 will help to explain the construction of the instrument.

A is a small cistern, made of malleable iron, and having two sockets *f* and *g* to receive the two glass legs B and C, thus forming a siphon. The leg C, 4 inches long, is permanently fixed to its socket. The leg B, rather more than 30 inches long, is provided at its open end with an iron collar *t*, ground air-tight, and fitting into the socket of the cistern; and as it reaches down to nearly the middle of the cistern the collar forms an airtrap round the mouth of the tube. The bottom of the cistern is provided with an iron pivot *h*, and a hole with a plug *i*; both are opposite to each other and to the glass tubes respectively. S is a cork that fits the short leg, and carries a siphon for the purpose of extracting from the filled barometer any excess of mercury when the instrument is placed upright, so as to adjust it to the lower zero line, which is marked on the diagram by a dotted line across the centre of the short leg C. D is the graduated disc with its socket *l*, which carries a moveable steel index *x* and a standard screw E. By means of three small screws *m* the disc can be fastened on the iron collar, embracing the upper part of the short leg C. The standard screw E is cut by Sir Joseph Whitworth and Co., Manchester. Its pitch is regulated so that

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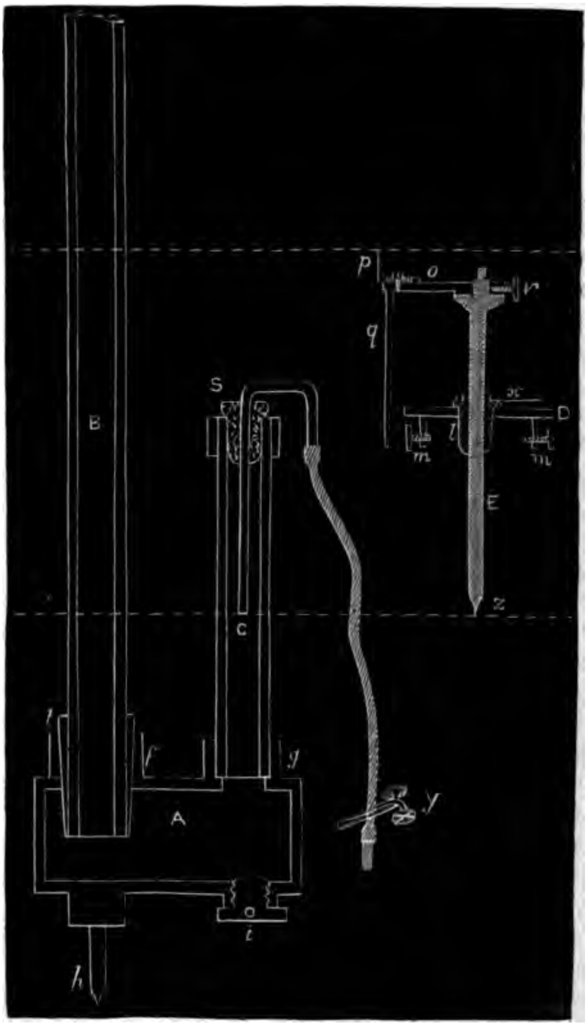
* Quarterly Journal, Vol. IV. p. 70.



each complete turn of the screw is equal to 0·02 inch, and each division of the disc being divided into ten equal parts is equal to 0·002 inch. On the upper end of the screw, a revolving hand *o* carries the needle *q* and the pointer *p*. This needle serves to mark the number of revolutions made by the screw round the disc, so as to ascertain the height of the lower column, whereas the pointer *p* shows the direct heights of the mercury on the long leg. This latter is accomplished by loosening the screw *v* and turning the hand against a 2-inch scale, marked on the long leg, the centre of which scale represents the upper zero line, dotted on the diagram across the long tube. The length of the standard screw, from the lower point *z* to the pointer *p*, is 3½ inches, being the distance between the upper and the lower zero line.

After the leg B has been filled with mercury, and the air extracted by the glass stopper, and the tube refilled as formerly described, the cistern A with its short leg C (closed with the cork and siphon S) is inverted, and its socket applied to the iron collar of the tube. The plug *i* having been removed, the funnel full of mercury is lowered into C and the mercury allowed to flow in and gently fill it, as well as the cistern up to or near to the plug hole. As the mercury rises to the centre of the cistern it unites with the column in the long leg, the only precaution necessary being to keep raising the point of the funnel and to remove it altogether as soon as the cistern is nearly filled. The plug is now screwed in, and the barometer put upright on its pivot, when any air remaining in the cistern, through not having filled it completely, will escape by the short leg.

As the mercury from the long leg descends and presses against the cork, the nipper *y* on the siphon is opened, and the mercury allowed to flow into the bottle and regulate itself to the end of the glass siphon, which reaches down to the lower zero line of the barometer scale, as shown in the diagram.

For very correct readings I should never recommend the so-called cistern barometers, as the zero of their scale hardly ever corresponds with the level of the mercury in the cistern; and even if a special arrangement for measuring small discrepancies could be adopted, as it often is, such a contrivance can never afford the same means of accuracy as that obtained in the short leg of the siphon barometer, in which the superficial area of the mercury is insignificant, so that the smallest fluctuation in the column is easily detected. As each division on the disc representing 0·002 inch occupies a length of about 0·5 inch there is no difficulty in appreciating the tenth part of the former amount, or say 0·0002 inch, a fraction hardly ever required. When registering barometrical heights, it is an important point to minimise labour and loss of time. The disc reading effects this admirably, and accuracy in setting the instrument can be heightened by the application of an electric current and a small bell, by which the near approach of the observer to the instrument will likewise be rendered unnecessary.

Another frequent source of error in barometrical readings is due to the continual change of temperature, which cannot easily be determined without an inner thermometer, or a similar one to mine, surrounded by a volume of mercury equal to that in the barometer tube. I would therefore suggest not only the adoption of this arrangement, but the adoption of siphon barometers exclusively, in which the lower column stands about the lower zero line of the scale, so as to omit the registration of temperature altogether; for an increase of temperature will elongate the mercurial column towards the vacuum, and will not affect it in the shorter leg, except that part of the column above or below the zero line; and the extension of this through the increase of temperature may be considered *nil*. Every eight days or so, a reading of both the long and short tubes might be taken, the temperature noted, and the height reduced to the freezing point, to check the correctness of the disc reading method.

Among other minor inconveniences arising from the unpractical form of barometers in general, I may enumerate a few.

The tapping method of overcoming friction I consider hardly effectual enough, as the vibration is imparted only to a short portion of the tube, and cannot well overcome the already existing tension in a falling or rising barometer, owing to the friction that exists all along the mercurial column; whereas, by a rapid turning of the tube on the pivot, a centrifugal motion through the short leg is momentarily produced which affects the entire mercurial column, and by which both menisci will invariably assume their natural heights.

Thirty-five years of practical experience on the West Coast of South America, in the capacity of mining engineer and director of scientific undertakings, enable me to form a tolerably correct idea of what is required in this line; and I hope the Fellows of this Society will admit the superiority of this new barometer over other forms, from the rapidity with which the fitting and putting up of the instrument is accomplished, the ease with which the minutest variation in the pressure of the atmosphere can be registered, and the simplicity by which the efficiency of the mechanical work, such as the correct divisions of its scale on the tube, can be tested without expense. That all barometric readings should be reliable and comparable is an important point to aim at; and in order to achieve this we ought, if possible, to adopt one and the same form of instrument, and that the simplest, the most sensitive, and the most easily controllable of all.

DISCUSSION.

Mr. WHIPPLE asked if it were certain that all traces of air and moisture could be removed from barometer tubes by mechanical means? He thought not. This was a very ingenious instrument, and he should be glad to put it up and read it beside an ordinary boiled tube for a time, with the view of determining the question.

Mr. BROOKE did not believe in barometers in which the mercury had not been boiled. The self-recording barometer at Greenwich had originally unboiled mercury in it, and the readings constantly differed from those of the standard barometer; the mercury was then boiled, and the results were afterwards satisfactory.

Mr. ELLIS, whilst testifying to the excellence of the mechanical arrangements in the barometer exhibited, wished to inquire how, with the system of reading off adopted by reference to the shorter leg only, the scale was determined, because it seemed difficult to measure the difference of capacity between the upper and lower legs as exactly as was necessary for the instrument to be used as a standard.

Mr. SYMONS doubted whether all the moist air could be removed from an unboiled tube; he preferred a boiled tube. He thought that the mercury in the short leg would get foul, and also that the electrical contact would oxidise the surface of the mercury. One very good feature about the instrument was its extreme portability.

Mr. STRACHAN considered the instrument an ingenious and beautiful specimen of mechanical workmanship. The fact, however, still remained that siphon barometers were not so good as cistern barometers. The proposed method of filling the tube was not in his opinion so good as the ordinary method, in which "boiling the mercury" was part of the operation. This boiling process was invented by Cassini in 1740, and was practised for some time. It then seemed to have got into disfavour, and was discontinued for many years, but it had been generally adopted by instrument makers during the present century. A comparison of a barometer a year old, which had been boiled, with one of the same age which had not been boiled, would show a striking difference in favour of the former. The boiling, by thoroughly purging away all traces of air and moisture, reduced the capillary action, and tended to preserve the mercury in a clean state for an indefinite time. He knew a marine barometer which had maintained its corrections unchanged for 17 years. However, it was only a question of time, and more especially of atmospheric condition, as regarded vapour and noxious gases, how long it would be before a boiled tube reverted to the unboiled condition. The tendency was always in this direction, so that the capillarity error in course of time underwent a change. He was of opinion that the capillary action in mercurial barometers was not yet satisfactorily known in all its phases.

Mr. **Brooke** remarked that in order to prevent the fouling of the mercury in the short leg of his recording barometer he had placed a thin annulus of steel on the surface, which appeared greatly to retard the oxidation.

Mr. **Ellis** said that, with reference to the remark that the indications of standard barometers changed in the course of time, the following circumstance might be mentioned. The Greenwich standard barometer had been filled for about 40 years, the Kew standard barometer for about 20 years. For certain reasons a very elaborate comparison was made between the two instruments in 1877. Several barometers were brought from Kew for comparison at Greenwich on three separate occasions; several hundred observations were made, the result being that the standard barometers differed only by ·001 inch. It would be a strange thing if the suggested cause of error should have affected both barometers by precisely the same amount.

Mr. **Bogen**, in reply, said that Mr. Whipple's remark that it was impossible to remove all traces of air or moisture from the barometer, or that at all events the removal would not be permanent, was not so serious an objection as might appear at first sight. The trial could not have been made with any of his cistern siphons, nor with pure and dry mercury. To insure success the moisture must be expelled beforehand by heating the mercury as well as the tube to 212°, and filling whilst hot. The non-observance of this condition accounted for the objections made. The best way to prove the absence of aqueous vapour, air and mercurial vapour, in a barometer was closely to inspect the vacuum with a lens, after gently inclining the tube, avoiding the metallic click, so as to prevent splitting the bubble, should it exist. If no bubble was visible the vacuum must be good. Every closed barometer not provided with this means of testing, by swinging and filling the vacuum, ought not to be admitted as a standard. But supposing the air-bubble should be visible, why not pump it out immediately, by an operation accomplished in a few minutes? The belief expressed by several speakers that the only way to expel air from the tube was by boiling the mercury (which meant heating it to nearly 700°) did not hold good against modern practice. The act of boiling mercury was acknowledged to be prejudicial on many points :—It altered the molecular structure of the glass tube, exposing it to fracture—It diminished the density of the mercury, and consequently caused the column to assume a greater length—It soiled the tubes and tarnished the brilliant appearance of the mercury, both *in vacuo* and in the air, by the oxide ascending to the surface. Tubes must be filled with chemically pure, dry, metal *in vacuo*, as practised by scrupulous mechanics on the Continent; or be filled by his glass stopper or iron cap method. The remark that it was not desirable to adopt the reading from the short branch of the tube, the scale being contracted, &c., would be appropriate if applied to the general form of siphon barometer, but not to the instrument before the meeting. That the siphon form was not so good for standards, owing to the uncertainty of capillary attraction, was a remark he fully appreciated for all barometers with narrow tubes; but this inconvenience would be more sensible in an ordinary cistern barometer, for the capillary action in the long leg of the siphon barometer was partly counteracted by that in the short leg. The objection, on account of the fouling of the mercury in the short leg, and which it was thought would be increased by the electric current, would apply to the ordinary siphon barometer, if a repeated swinging or pumping was imparted to the column, but did not hold good in the present case. Suppose the electric current oxidised the mercury every time the contact was made, and that this oxide or any impurity was lodged on the lower meniscus, it would be removed by dipping the column into the cistern, and the impurity would adhere to the sides of the glass tube (short leg) and to the interior rough sides of the cistern. He would direct attention to the new form of air-trap in the cistern, and to the drying tube in the short leg; the latter would prevent moisture from entering the cistern, and the former the air from ascending into the long leg. If any inconvenience should be felt by the short branch assuming in time a dirty appearance, the dirt could be removed with the cleaning rod, or a piece of pencil covered with a strip of tissue paper, linen, &c., swinging the instrument into an inclined position, and removing the disc. Air-traps with contracted openings were prejudicial to the sensitiveness of barometers, but this objection did not apply to his instrument. The fact of having avoided the contracted air-trap and the capillary ends, retaining nevertheless all the advantages they otherwise possessed, showed that the cistern-siphon had some practical value. The idea of constructing a siphon barometer which could be taken to pieces so as to clean the glass and refill it, was, he imagined, a happy one, and he thought if observers made themselves familiar with the instrument they would adopt it, not only as a travelling barometer, but also as a stationary standard. The drying tube afforded the only means of preserving barometers for years in sound condition, for it was through the moisture inside the glass tube that the air adhered to the glass, and which might in time creep up to the vacuum; besides, pure mercury when dry never became tarnished. The back pressure, owing to mercurial vapour in the Torricellian vacuum, was insignificant, but as its existence was undeniable it ought to be taken into consideration. A very pertinent remark had been made expressing some doubt as to the perfect equality of the diameter of the tube of both legs. To this he would say that the short leg was cut off from the top of the long tube before it was sealed, and could not well differ from it in a well-formed tube, but the two legs could be tested by pouring small quantities of mercury into the short branch by the opening of the drying tube, and the heights compared, and if unequal, the tube be rejected.

VIII. *On the Relation existing between the Duration of Sunshine, the Amount of Solar Radiation, and the Temperature indicated by the Black-bulb Thermometer in vacuo.* By G. M. Whipple, B.Sc., F.R.A.S., F.M.S., Superintendent of the Kew Observatory. (Plate XXV.)

[Received January 8th—Read February 19th, 1879.]

The subject of solar radiation, as measured by readings of a blackened bulb thermometer *in vacuo*, has already been discussed with considerable fulness in papers read before the Meteorological Society by Mr. Park Harrison, the Rev. Fenwick Stow, and Mr. Nash; but although Mr. Harrison, in his paper, printed in the Quarterly Journal of the Society, Vol. II. p. 455, has considered solar radiation in its relation to cloud and vapour, I do not find that the question has been examined in the light in which I have now, by the kind permission of the Kew Committee, the honour of placing it before the Society.

The investigation could only be carried out by the aid of the sunshine recorder, for which meteorologists are mainly indebted to Mr. Campbell and Mr. Scott. The observations were made in 1877 at the Kew Observatory, the values for the daily duration of sunshine being those already discussed as to their relation to the similar results obtained at the Royal Observatory, Greenwich, in the Quarterly Journal, Vol. IV. p. 201.

The Rev. F. Stow has shown, in his exhaustive paper on the Black-bulb thermometer, in the Quarterly Journal, Vol. I. p. 138, that great variability

SOLAR RADIATION, TEMPERATURE OF BLACK
KE

Solar R
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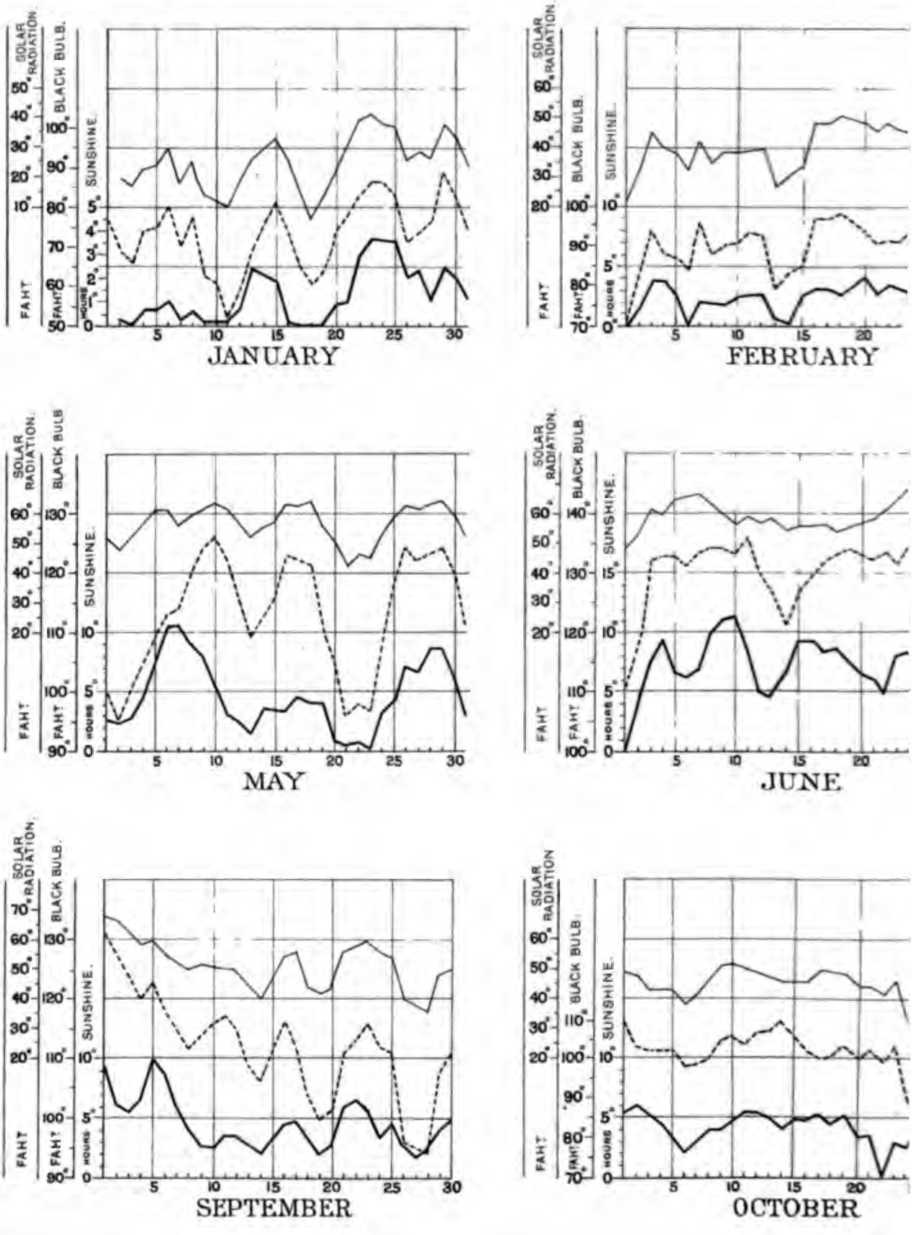


JANUARY

FEBRUARY

MAY

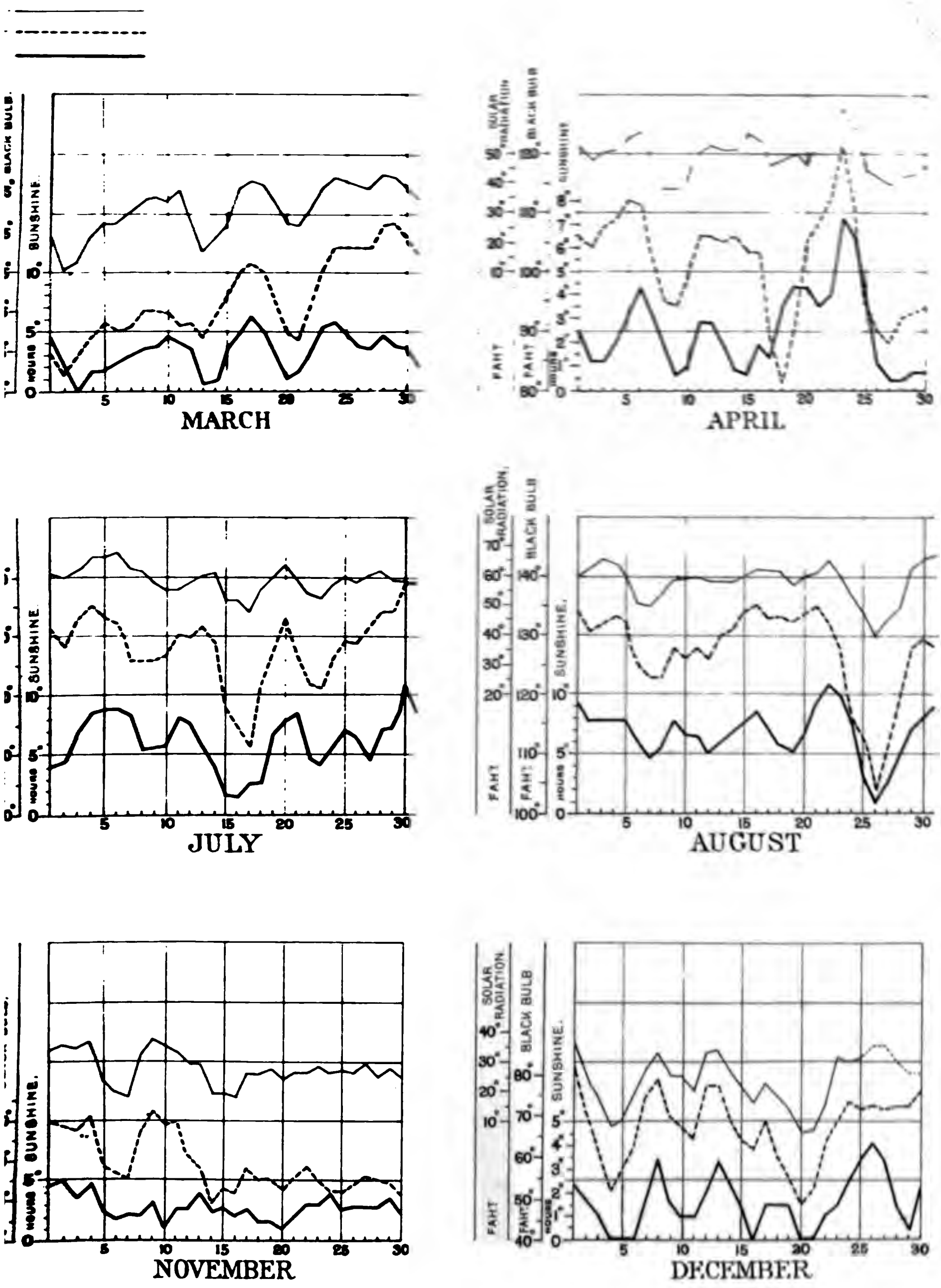
JUNE

SEPTEMBER

OCTOBER

OMETER IN VACUO AND DURATION OF SUNSHINE.

RY 1877.



Mallry & Sons Lith.

btains among the readings of this class of instruments; and although ingenuity has been bestowed upon it by opticians in the endeavour to e to the utmost the causes which tend to bring about the observed discre- es, their efforts have not as yet been crowned with entire success.

the Kew Observatory, in order to reduce the instrumental error of this of observation to a minimum, four thermometers are employed—two egretti and Zambra's patent, and two of Hicks's patent, as nearly as ble of the same dimensions, and compared rigorously with ordinary ard thermometers. These instruments are read and set daily at 10 a.m., eing fixed side by side on a frame-work with the bulbs 4 feet above the , freely exposed on all sides, their mean may be assumed to be a ably correct value of the solar power at the Observatory, as measured lack-bulb readings.

cording to the rule laid down by Mr. Stow in the Proceedings, Vol. IV. 4, the excess of the maximum temperature indicated by these blackened thermometers, over the maximum temperature recorded in the shade, is as the amount of solar radiation for the day.

e subject of the measurement of solar radiation having been brought e notice of the Kew Committee, one of the members suggested the f a form of the instrument somewhat different to that ordinarily employed; an experimental thermometer having been constructed for me by Hicks, readings were made of it daily for several months during the ner of 1878.

comparison of these readings with those of the black bulbs led my friend oadjutor Mr. Baker to remark that the indications of the latter were to ge extent influenced by the duration of sunshine, whilst I was more ed to conclude that the relation of the two phenomena to one another l be one of cause and effect, and that a day of intense solar radiation l probably be followed by a clearer sky.

also found that Mr. Stow had determined experimentally that the erature of the black-bulb thermometer is raised unduly, on partially ed days, and he assigned as the cause that the sun's heat reflected from the ce of bright cumulus clouds, being composed of rays of high refrangibility, passes through the glass jacket, and is absorbed by the black bulb, t the corresponding rays reflected from the ground on to the instrument, rays of dark heat, are unable to penetrate the glass. With a view of itting the question to proof, I plotted down as curves first the black readings and the hourly duration of sunshine for each day, and then l the curve for solar radiation. It was at once evident there was a relation between the phenomena of solar radiation and sunshine, but g to the great range of the black-bulb thermometer the exact nature of onnection was not immediately apparent.

examining the observations a source of difficulty was found in the method gistering the temperatures. The custom is to set the instruments daily a.m., and to enter their readings as the maximum black-bulb tempera- for the previous day; hence there is an uncertainty as to whether the

TABLE I.

Duration of Sunshine, Reading of Black-Bulb Thermometer *in vacuo*, and Amount of Solar Radiation.

1877.	January.			February.			March.			April.			May.			June.			July.			August.			September.			October.			November.			Decemb.		
	Sun.	B. B. T.	Sol. Rad.	Sun.	B. B. T.	Sol. Rad.	Sun.	B. B. T.	Sol. Rad.	Sun.	B. B. T.	Sol. Rad.	Sun.	B. B. T.	Sol. Rad.	Sun.	B. B. T.	Sol. Rad.	Sun.	B. B. T.	Sol. Rad.	Sun.	B. B. T.	Sol. Rad.	Sun.	B. B. T.	Sol. Rad.	Sun.	B. B. T.	Sol. Rad.	Sun.	B. B. T.	Sol. Rad.	Sun.	B. B. T.	Sol. Rad.
Day.	h.	°	°	h.	°	°	h.	°	°	h.	°	°	h.	°	°	h.	°	°	h.	°	°	h.	°	°	h.	°	°	h.	°	°	h.	°	°	h.	°	°
1	..	77	..	0·0	70	22	4·6	85	41	2·5	106	52	2·4	100	51	0·2	110	51	3·9	131	61	9·1	134	61	9·5	131	68	5·4	109	49	4·6	100	45	2·8	80	34
2	0·1	69	20	1·4	81	32	1·9	79	31	1·3	104	48	2·2	95	47	4·3	118	53	4·3	128	60	7·6	131	63	6·2	127	66	6·2	104	48	5·0	99	46	1·7	71	25
3	0·0	66	17	3·8	94	45	0·0	83	33	1·3	108	50	2·8	100	51	7·3	132	60	7·0	133	63	7·6	132	65	5·5	124	63	5·4	102	43	3·2	98	45	1·1	62	16
4	0·7	74	23	3·8	88	40	1·6	89	41	2·0	109	52	4·4	104	56	9·4	133	59	8·3	135	67	7·7	133	64	6·6	120	59	4·5	102	43	4·7	101	47	0·0	53	8
5	0·7	75	24	2·4	87	38	1·7	92	47	3·3	112	56	7·9	109	60	6·3	133	64	8·7	133	67	7·3	132	60	10·1	123	60	3·1	102	43	2·2	88	33	0·0	59	11
6	1·0	81	30	0·1	84	32	2·3	90	47	4·3	111	57	10·3	113	60	6·0	131	66	8·8	132	68	6·1	125	51	8·6	118	55	2·1	98	39	1·7	86	29	0·0	65	17
7	0·3	70	19	1·9	95	42	3·1	91	50	3·2	103	49	10·5	114	55	6·7	133	66	8·2	126	63	4·7	123	50	5·8	115	53	3·0	98	42	2·0	85	28	1·7	76	28
8	0·6	78	27	1·9	88	34	3·4	95	54	1·8	95	39	8·9	120	57	9·7	134	63	5·4	126	62	5·4	123	54	3·6	112	51	3·9	100	46	2·0	98	42	3·4	81	33
9	0·3	63	14	1·8	90	38	3·5	95	55	0·6	94	38	7·8	124	61	11·0	134	60	5·6	126	58	7·3	128	59	2·4	114	52	3·9	105	51	3·1	102	47	1·7	71	26
10	0·3	59	12	2·2	91	38	4·4	94	53	1·0	99	42	5·3	126	63	11·2	133	56	5·7	127	56	6·2	126	59	2·4	116	50	4·8	106	52	1·1	99	45	1·0	68	24
11	0·3	52	10	2·3	93	39	4·0	91	47	2·8	106	52	3·0	122	61	8·4	136	59	7·9	130	56	6·2	128	60	3·5	117	51	5·3	104	50	2·6	100	43	1·0	65	20
12	0·7	58	18	2·3	92	39	3·4	92	45	2·8	106	53	2·3	116	57	5·0	130	57	7·4	130	58	5·0	126	59	3·4	115	49	5·3	106	49	2·3	91	39	1·9	79	33
13	2·4	69	26	0·4	79	27	0·4	88	37	2·1	105	52	1·4	109	51	4·8	127	58	5·4	131	60	5·5	130	59	2·5	109	44	4·9	107	47	3·9	89	38	3·3	79	34
14	2·1	75	30	0·3	83	31	0·8	93	42	0·9	106	52	3·4	113	54	6·6	121	55	4·0	129	61	6·4	131	58	1·6	106	41	4·0	109	46	2·4	80	29	2·3	70	27
15	1·8	81	33	2·6	84	34	3·1	98	47	0·6	103	51	3·3	116	56	9·4	127	56	1·7	118	52	7·1	134	60	3·5	112	48	4·9	105	46	2·7	83	29	1·5	66	21
16	0·1	75	26	3·1	97	48	4·6	105	58	1·9	103	54	3·3	123	63	9·3	129	56	1·5	115	52	8·3	135	62	4·5	117	55	4·9	102	47	2·0	82	28	0·1	63	16
17	0·0	66	15	3·1	97	48	6·3	107	60	1·3	88	42	4·6	122	63	8·2	132	56	2·4	111	48	6·9	133	62	4·7	113	56	5·1	100	50	2·6	88	36	1·6	71	23
18	0·0	60	7	2·6	98	50	5·3	105	59	3·6	81	45	4·0	121	64	8·5	133	55	2·7	122	56	5·7	133	61	2·7	104	45	4·5	101	49	1·5	85	36	1·6	61	17
19	0·0	64	13	3·3	96	49	3·5	96	52	4·3	95	46	4·0	111	55	7·9	134	56	6·3	127	60	5·1	132	57	1·7	100	42	5·2	103	48	1·5	85	37	1·6	56	14
20	0·9	73	23	4·1	94	49	1·2	89	46	4·3	105	53	0·9	105	50	6·6	133	57	7·8	133	64	6·6	134	60	2·8	101	45	3·4	100	44	1·0	83	34	0·0	49	6
21	1·0	77	31	2·7	90	46	1·5	88	45	3·6	108	54	0·5	96	43	6·0	132	58	8·2	127	59	9·0	135	62	6·1	111	56	3·5	102	44	2·2	86	36	0·0	53	7
22	3·0	84	39	3·2	91	49	3·2	96	51	4·1	113	59	0·7	98	46	5·2	133	63	4·6	122	54	10·5	132	65	6·4	113	58	0·3	99	42	3·0	88	36	1·1	64	16
23	3·6	86	41	3·0	91	46	5·3	106	58	7·4	121	65	0·4	97	45	7·9	131	64	4·1	121	53	10·0	127	61	5·5	116	60	2·9	104	47	3·0	86	38	1·5	69	31
24	3·6	86	38	2·7	93	45	5·7	111	61	6·4	111	58	3·1	108	53	8·2	134	68	5·4	126	57	7·4	116	53	3·3	112	56	2·5	89	35	3·8	82	37	2·6	75	30
25	3·5	83	37	2·1	89	39	4·2	111	60	4·0	95	44	4·3	118	58	7·5	131	65	7·2	129	60	3·8	112	49	4·5	111	54	3·7	85	30	2·6	82	37	3·3	73	32
26	1·9	72	25	2·8	92	46	3·7	111	59	1·2	90	41	6·9	124	61	6·0	133	66	6·5	129	59	1·1	104	40	2·5	96	40	1·5	82	27	2·7	84	37	4·0	74	35
27	2·3	74	28	5·4	91	50	3·5	111	59	0·5	88	40	6·7	122	61	6·8	130	60	4·6	131	61	2·6	111	44	1·8	95	38	3·7	95	39	2·6	86	37	3·2	73	35
28	1·1	76	27	6·0	92	52	4·7	116	62	0·5	92	42	8·3	123	63	10·3	133	59	7·0	134	62	5·2	118	49	2·1	94	36	2·5	94	37	2·7	85	35	1·4	74	31
29	2·5	89	38	..	..	..	3·9	117	62	0·7	93	43	8·5	124	64	9·6	135	59	7·1	134	59	7·0	128	63	3·9	108	48	2·6	95	37	3·5	84	37	0·5	74	27
30	2·1	83	35	..	..	..	3·5	113	58	0·7	94	46	6·1	120	59	6·8	133	60	10·7	139	58	8·1	129	66	5·2	111	49	2·5	95	37	2·3	82	35	2·1	77	26
31	1·4	73	25	..	..	..	2·5	109	55	..	..	..	3·0	110	50	..	..	..	8·4	139	57	8·8	128	67	..	..	..	4·8	102	45	..	..	..	..	..	..

temperature registered really occurred on the day credited with it or on the next. As a means to some extent of removing these irregularities, I have adopted the plan of smoothing the curve by taking 8-day means, and entering them as the values for the middle day. Although this system of dealing with observations may be objected to, yet I may claim in its favour the success which has attended its introduction in rainfall and other investigations.

Table I. (p. 144) gives the values so obtained for every day of the year 1877, and the diagram represents the three phenomena plotted down in curves for each month.

It has been found necessary to treat the months separately, for several reasons. In the first place, the summer variations in temperature, being so much larger than those observed in winter, require to be represented on a smaller scale; and secondly, owing to seasonal change, the zeros of the several scales have to be shifted in order to bring the curves into juxtaposition.

A glance at the curves shows that the three phenomena are intimately connected with each other, the curves rising and falling together almost all through the year There is only one important exception to this rule, viz. in the case of a rise in the readings of the black-bulb thermometer early in May, some four days subsequent to the maximum duration of sunshine for the period. This variation is so marked a deviation from the general behaviour of the curves, that I can only attribute it to erroneous readings, or to the prevalence of cloud of a peculiar nature as regards the transmission of heat rays. It would be possible to determine from the curves a series of constants, by means of which the amount of solar radiation might be approximately determined from the number of hours of sunshine on any day; but I have thought it better to wait for the results of several years' observations before attempting to fix these values.

Summarising the observations, we have in Table II. (p. 146) for every month, and also for one year, the comparisons of the times of occurrence of maxima and minima of both radiation and black-bulb curves as compared with the sunshine curves.

From this Table we find that, taking both maxima and minima into consideration, there were 70 cases of agreement between the solar radiation and sunshine in their times of occurrence, and 6 of disagreement, whilst the former phenomenon preceded the latter by a short interval 10 times, and succeeded it 16 times. The black bulb and sunshine duration agreed in 62 dates against 7 dates of opposition, and the thermometer curve advanced before the sunshine on 18 occasions and lagged behind it on 14.

I think it may therefore be safely concluded that the measure of solar radiation at any place, as given by the black-bulb thermometer, is only to be considered as an indication of the relative presence or absence of cloud from the sky at the locality, and so its use as a meteorological instrument may with advantage be set aside in favour of the sunshine recorder, which is not influenced by the elements of uncertainty inseparable from the former instrument.

I have to express my thanks to the Meteorological Council for permission

TABLE II.—Solar Radiation and Black Bulb Temperatures for 1877. Time of occurrences as compared with those of Sunshine duration.

Month.	Solar Radiation.							Black Bulb Thermometer.						
	Maximum.			Minimum.			Opposed.	Maximum.			Minimum.			Opposed.
	Before.	Same Date.	After.	Before.	Same Date.	After.		Before.	Same Date.	After.	Before.	Same Date.	After.	
January	.	5	1	..	4	..	..	..	3	1	..	3	..	1
February	1	4	..	2	2	..	1	2	3	1	2	2	..	1
March ..	..	3	1	1	2	1	..	1	2	1	1	2	1	..
April	1	3	1	..	4	..	2	1	2	..	..	3	..	1
May	..	3	1	..	4	..	1	2	1	.	..	4	..	1
June	1	1	1	.	..	1	2	..	2	2	..	1	1	2
July	2	2	1	1	1	3	..	2	2	1	2	1	2	..
August ..	..	3	..	..	3	..	..	2	2	..	..	4	..	..
September	..	3	1	..	3	2	..	1	2	1	1	2	2	..
October ..	1	4	..	..	3	..	..	1	4	..	..	3	..	1
November	..	3	1	..	4	1	..	..	3	..	..	5	1	..
December	..	2	..	..	4	..		..	2	..	..	4	..	..
Totals ..	6	36	8	4	34	8	6	12	28	7	6	34	7	7

to make use of their observations in this paper, and to Mr. Foster for kind assistance in preparing the diagrams illustrating it.

DISCUSSION.

Mr. **Brooke** asked whether the differences in April and May were not due to the air temperature.

Professor Archibald wished to know why Mr. Whipple had taken 3-day means instead of the actual daily observations; adding that such a plan tended to eliminate many small irregularities from the curves, whose presence might either add to or detract from the number of corresponding points at present visible.

Mr. **Whipple** said that from the circumstance of the thermometers being read at 10 a.m. he could not always tell to which day the readings belonged: at first he plotted down the daily observations, but the curves were so rough that he had to adopt this process to smooth them down, and to make them appear in an intelligible form.

Mr. **Gaster** asked at what time the observations of the maximum temperature in the air were read, those in the sun being read at 10 a.m.? Referring to ordinary observers, he could not conceive why, as the observers had to read the dry and wet bulb thermometers twice a day, they could not read the maximum and minimum thermometers also at both times. They would then be astonished to find how often in winter the maximum occurred during the night and the minimum during the day, nor could they fail to observe the deep significance of such occurrences.

Mr. **Whipple** replied that the maximum temperature of the air was observed at 10 p.m.

Mr. **Symons** was surprised to hear that the shade thermometers were read at 10 p.m., and the solar instruments at 10 a.m. He thought that if observations of the solar thermometers were taken every hour, and compared with the sunshine record, some good results might be obtained; until this was done it would not be possible to decide which was the better instrument.

Mr. **Sawyer** thought that it was desirable to check the recorder by estimating the duration of sunshine according to the Scotch method. He also considered that the smoke from London would have some effect on the radiation at Kew.

Mr. **Whipple** said that a very thin cloud intercepted the sun's rays, and pped the registration of the instrument. The custom at Kew in determining duration of sunshine, was only to count the time of the actual burning of card.

Mr. Ellis remarked that *very* thin cloud in front of the sun did not stop the ister at Greenwich. Generally speaking registration might be said to cease en the sun could be looked at without pain. In reports it was specified that register was that of *bright* sunshine. Any trace undoubtedly made by the was counted.

PROCEEDINGS AT THE MEETINGS OF THE SOCIETY.

January 15th, 1879.

Ordinary and Annual General Meetings.

Charles Greaves, M.Inst.C.E., F.G.S., President, in the Chair.

William Carey Coles, M.D., Bourton-on-the-Water;
William Wymond Hamley, M.A., Clare College, Cambridge;
Charles Edward Harris, Tylney Hall, Winchfield;
Henry B. Joyner, San Paulo, Brazil;
William Jones Lloyd, M.A., D.L., Langlebury, Watford;
J. H. McClure, F.R.G.S., Beaconsfield Club, Pall Mall, S.W.;
Grayson Madders, M.R.A.S., Grosvenor Terrace, Richmond;
James Monks, Aden Cottage, Durham;
Edward Chapman Morrell, Broughton, Banbury;
Edward Murphy, Dunfanaghy, Letterkenny, Ireland;
George Henry Nelson, The Lawn, Warwick;
G. F. North, Cheswardine, Market Drayton;
T. Pain, The Grove, Basingstoke;
Pickering Phipps, M.P., Northampton;
Thomas Rigby, Sutton Mill, Preston Brook, Cheshire;
Archibald Rogers, 41 Parliament Street, S.W.;
William Scotson, Rose Lane, Aigburth, Liverpool;
Henry Townshend, Caldicote Hall, Nuneaton;
Thomas John Turnbull, Wimborne St. Giles, Dorset; and
Herbert Sowerby Wallis, 1 Springfield Road, St. John's Wood, N.W.,
re balloted for and duly elected Fellows of the Society.

The President then declared the Ordinary Meeting closed, and announced t the Annual General Meeting had commenced.

Mr. C. Harding and Mr. M. Jackson were appointed Scrutineers of the llot for Officers and Council.

Dr. Tripe read the Report of the Council and the Financial Statement for the st year. (p. 113.)

It was proposed by the President, seconded by Mr. Eaton, and resolved:— That the Report just read be received and adopted, and circulated among the llows."

It was proposed by Dr. Tripe, seconded by Mr. Dymond, and resolved:— That the cordial and best thanks of the Society be communicated to the uncil of the Institution of Civil Engineers, for having granted the Society e permission to hold the Meetings in the Rooms of the Institution, and also the use of the Theatre for the Lectures."

It was proposed by Mr. Scott, seconded by Mr. Symons, and resolved:— That the thanks of the Society be given to the President for the ability and courtesy displayed by him in the Chair, and for organising the Lectures and defraying all the expenses."

It was proposed by Mr. LAW, seconded by Mr. DYASON, and resolved:—"That the thanks of the Society be given to the Officers and other Members of the Council, and to the Auditors for their services during the year."

It was proposed by the Rev. G. MULLINS, seconded by Mr. SOWERBY, and resolved:—"That the thanks of the Society be given to the Standing Committees, and that they be requested to continue their duties till the next Council Meeting."

The PRESIDENT then delivered his Address. (p. 103.)

It was proposed by Mr. DINES, seconded by Mr. WHIPPLE, and resolved:—"That the thanks of the Society be given to the President for his Address, and that he be requested to allow it to be printed in the Society's Journal."

The PRESIDENT announced the result of the ballot, and declared the following gentlemen to be the Officers and Council for the ensuing year:—

President.

CHARLES GREAVES, M.Inst.C.E., F.G.S.

Vice-Presidents.

CHARLES BROOKE, M.A., F.R.S., F.R.C.S.
HENRY STORKS EATON, M.A.
REV. WILLIAM CLEMENT LEY, M.A.
CAPT. HENRY TOYNBEE, F.R.A.S.

Treasurer.

HENRY PERIGAL, F.R.A.S.

Trustees.

SIR ANTONIO BRADY, F.G.S.
STEPHEN WILLIAM SILVER, F.R.G.S.

Secretaries.

GEORGE JAMES SYMONS, F.R.S.
JOHN WILLIAM TRIPE, M.D.

Foreign Secretary.

ROBERT HENRY SCOTT, M.A., F.R.S.

Council.

ARTHUR BREWIN, F.R.A.S.
EDWARD ERNEST DYMOND.
WILLIAM ELLIS, F.R.A.S.
ROGERS FIELD, B.A., M.Inst.C.E.
REV. CHARLES HIGMAN GRIFFITH, B.D.
WILLIAM JOHN HARRIS, M.R.C.S.
JAMES PARK HARRISON, M.A.
JOHN KNOX LAUGHTON, M.A., F.R.A.S.
ROBERT JOHN LECKY, F.R.A.S.
HON. FRANCIS A. ROLLO RUSSELL.
RICHARD STRACHAN.
HENRY SAMUEL TABOR.

The Meeting then terminated.

FEBRUARY 19th, 1879.

Ordinary Meeting.

CHARLES GREAVES, M.Inst.C.E., F.G.S., President, in the Chair.

WILLIAM KENNEDY, 11 Portland Place, Brighton;
HENRY ALEXANDER KETTLE, F.R.G.S., 53 Fleet Street, E.C.;
ROBERT LAKE, Oakley, Rochester;
JAMES L. MCCANCE, F.R.A.S., Rathfern, Rayner's Road, Putney Hill, S.W.;
FRANCIS NEWMAN, 5 St. Thomas Street, Ryde;
WILLIAM PAVER, Peckfield, South Milford, Yorkshire;
FRANCIS WILLIAM SILVESTER, Hedges, St. Albans;
WILLIAM CHARLES SPOONER, Eling House, Eling, Southampton;
CHARLES TRIFFIT WARD, Arnold House, Blackpool;
JOHN WATSON, Waresley, Kidderminster; and
R. WORSLEY WORSWICK, Normanton Hall, Hinckley,
were balloted for and duly elected Fellows of the Society.

The following Papers were read:—

"Diurnal Variations of Barometric Pressure in the British Isles." By FREDERICK CHAMBERS. (p. 133.)

"On a Standard Cistern Siphon Barometer." By FREDERICK BOGEN. (p. 137.)

"On the relation existing between the duration of Sunshine, the amount of Solar Radiation, and the temperature indicated by the Black-Bulb Thermometer *in vacuo*." By GEORGE MATHEWS WHIPPLE, B.Sc., F.R.A.S. (p. 142.)

"The Meteorology of Buenos Ayres." By WILLIAM B. TRIPP, Assoc.Inst.C.E. (Abstract.)

THIS paper is based upon observations taken at Buenos Ayres during portions of the years 1874, 1875, and 1877. The following are the most important of the results arrived at:—

Winds.—The prevailing wind during the summer is from the NE and N, and during the winter from NW and SW, the NE being the wind of fine, though warm and oppressive weather, and the SW the healthy, cold and stormy wind.

When the wind settles well in the NE, it generally continues in that quarter till a storm comes, and is always accompanied by a falling barometer. The SW wind comes as a storm from across the Pampas, and is, consequently, known as the "Pampero." It causes the barometer to rise rapidly, and is usually preceded by the wind veering with the sun through N and NW; but sometimes the wind backs round by E and SE, and a gale from this point is the most disastrous for the port of Buenos Ayres, as it drives many craft ashore, on the top of extraordinarily high tides propelled by the SE wind. The wind having settled in the NE, the temperature gradually rises as the barometer falls, the air becomes extremely humid and oppressive, clouds gather in the W and SW, and lightning is seen to proceed from them as the evening approaches. This is a sure sign of a "Pampero," which is preceded by a dust-storm; and if it is accompanied by rain the first drops consist of diluted mud, while a violent thunderstorm is usually experienced. The wind sweeps across the Pampas with great force, and causes a complete change in the condition of the air, the barometer rising and the temperature falling suddenly, after which the wind again settles in the NE, and the changes proceed as before. Such a storm may last for a few hours, or for six or seven days, the longest duration being commonly about three days. This "Pampero Sucio," or "dirty Pampero," as it is called when accompanied by long continued rain, is much dreaded by those engaged in pastoral pursuits, as, from the clayey nature of the soil, three days of wet weather render the ground so excessively muddy that the flocks of sheep, becoming mired, die in great numbers in the biting wind. Storms are generally most severe between the end of July and the end of September.

During the warmer months a sea-breeze, called the "Viraro," blows almost daily in the afternoon and evening from the SE and E, though the breeze occasionally is felt from the colder land regions towards the SW. This breeze may be observe as early in the spring as August.

Rainfall.—No observations appear to have been made by the author. Th annual fall (as deduced from other sources) is given as from 23 to 46 inches, th mean (1861-1870) being 33·50 in. Several instances of excessive falls are als mentioned; *e.g.* 31st March, 1870, 5·71 in. in 4 hours; 11th and 12th Octobe 1874, 4·75 in. in 24 hours; 30th April to 2nd May, 1877, 8·62 in. in 28 hours; o which about 6 in. fell in 13½ hours.[*]

Hailstorms, with stones of very large size, sometimes take place. On July 16th, 1876, a storm occurred, in which one of the stones, pear-shaped, was 2¼ in. long, the smaller diameter being 2 in. and the circumference 9 in. Roofs were shattered by it, and great damage done. Such a storm as this does not occur more than once in four or five years.

The greatest heat during the years 1873-1877, was in February, 1877, when the temperature on the shady side of the streets rose to 105°, with severe hot winds The temperature fell to 60° in a few days. The most rapid change of temperature noticed was from 85° in the shade during the day to 55° during the succeeding night. This was in the same month of February, 1877.

Dr. Gould, Director of the Observatory of Cordoba, is establishing meteor logical stations in various parts of the country, under the care of residents, t instruments being sent from the Central Observatory. These cannot fail to gi interesting and valuable results.[†]

In the course of the evening a Testimonial Album was presented to Mr. Symo containing nearly 200 photographs of Fellows of the Society, in "recogniti of the valuable work done by him for the Society by inspecting its stations testing the instruments used by the observers, independently of the services re dered by him as one of the Secretaries for several years."

The Meeting was then adjourned.

RECENT PUBLICATIONS.

AMERICAN JOURNAL OF SCIENCE AND ARTS. Vol XVII. January, 187 8vo.

Contains:—Contributions to Meteorology; being Results derived from examination of the observations of the U.S. Signal Service and from otl sources. By Prof. Elias Loomis. Tenth Paper, with two Plates. The subje treated of are:—Storms of the Atlantic Ocean; Fluctuations of the Barome on Mt. Washington and Pike's Peak; High Winds on Mt. Washington and Pike's Peak.

A VISIT TO SOUTH AMERICA; with Notes and Observations on the Mo and Physical Features of the Country, and the Incidents of t Voyage. By EDWIN CLARK. 8vo, pp. 355.

Among much other information, this work gives an account of the Tra Winds, Vapour and Clouds, the Pampas, Climate and Meteorology of Buen Ayres and Arapey. The Appendix is devoted to rules for the estimation heights by the barometer.

ANNUAIRE DE LA SOCIETE METEOROLOGIQUE DE FRANCE. Tome XX Bulletin des Sciences, feuilles 19-32. 4to.

Principal contents:—De l'oscillation diurne du Baromètre, par E. Renou. Electromètre enregistreur de M. Mascart, par A. Angot.—Note sur l'invasi des sauterelles en Algérie (janvier-août 1877), par Capt. H. Brocard.—Tac solaires et pluies, par C. Meldrum.—Note sur la transparence de l'atmosphère, par E. Renou.—Note sur l'ascension scientifique en ballon du 31 Octobre, 1878, par L. Tridon.—Sur l'observation du vent par les girouettes, par E. Renou.—Sur l'oscillation diurne du baromètre, par E. Cousté.—Sur la classification des nuages et des courants aériens, par le comte Sansac de Touchimbert.

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[*] For further particulars relating to this fall of rain, and the accompanying storm, as well as Climate of Buenos Ayres, see 'A visit to South America,' p. 174. By EDWIN CLARK, M.Inst.C.E., F. —*Ed.*

[†] A volume has been published, 'Anales de la Oficina Meteorológica Argentina,' by B. A. Go Tomo I. Clima de Buenos Aires. 1878. 4to, pp. 522. Plates 17.—*Ed.*

Annuaire de l'Observatoire de Montsouris pour l'an 1879. Météorologie, Agriculture, Hygiène. 8vo, pp. 520.

Among other information this contains as usual 'Observations Météorologiques anciennes faites à Paris,' the rainfall commencing in 1689, and the temperature in 1699; and also 'Description des Instruments employés à l'Observatoire de Montsouris,' illustrated with woodcuts, and extending over 157 pages.

Behm's Geographisches Jahrbuch. Vol. VII. 8vo.

Contains:—Bericht über die Fortschritte der geographischen Meteorologie, von Dr. J. Hann. pp. 75. This is a summary of the progress of Meteorology in all parts of the world during the two years 1876-7.

Zeitschrift des K. preussischen statistischen Bureaus, 1878. 4to.

Contains:—Die Organisation des meteorologischen Dienstes in den Hauptstaaten Europa's, von Dr. G. Hellman.

Wissenschaftliche Ergebnisse aus den monatlichen Uebersichten der Witterung, Jahrgang I. und II. (1876-7), pp. 26.

Supplementary number of the 'Monatliche Uebersicht' for 1877; with monthly and seasonal charts of the tracks of barometric minima over the North of Europe during the five years 1873 7.

Instruction fuer die Beobachter an den meteorologischen Stationen im Koenigreich Bayern. Herausgegeben von der k. b. meteorologischen Central-Station Muenchen. 36 pp. 8vo.

Uebersicht ueber die Witterungsverhaeltnisse im Koenigreiche Bayern waehrend des Januars und des Februars, 1879.

The former are the instructions to the observers of the recently organised meteorological system in Bavaria; and the latter are monthly reports of the weather, with results from 14 second order stations, and 17 third order stations.

Sitzungsberichte der k. Akademie der Wissenschaften, 1878, Oct. 8vo.

Contains:—Zur Meteorologie der Alpengipfel, von Dr. J. Hann. pp. 38.

Reduction of Twenty Years' Photographic Records of the Barometer (1854-73), and Dry and Wet Bulb Thermometers (1849-68); and Twenty-seven Years' Observations of the Earth Thermometers (1847-73), made at the Royal Observatory, Greenwich, under the direction of Sir George Biddell Airy, K.C.B., &c., Astronomer Royal. 4to.

Tables, pp. 108; with Explanatory Introduction, pp. 34.

Report of the Meteorological Council to the Royal Society, for the period of ten months ending 31st of March, 1878. 8vo.

In addition to the reports on the work of the office, including Ocean Meteorology, Weather Telegraphy, Land Meteorology of the British Islands, &c., there is a paper by Prof. J. D. Everett, entitled 'Account of Experiments on Atmospheric Electricity, conducted at Kew.'

Proceedings of the Royal Society. Vol. XXVIII. Nos. 190-194. 8vo.

The Meteorological Papers are:—No. 190, Report of the Kew Committee for the year ending October 31, 1878.—No. 192, On Dry Fog, by Prof. E. Frankland.

Philosophical Transactions of the Royal Society. 1878, Part II. 4to.

Contains:—On the Determination of the Constants of the Cup Anemometer by experiments with a whirling machine, by Rev. T. R. Robinson, D.D.

METEOROLOGICAL OBSERVATIONS AT STATIONS OF THE SECOND ORDER for the year 1877. Issued by the Meteorological Council. 4to, pp. 165.

Contains :—Daily observations *in extenso* from 23 stations, and monthly summaries from 32 stations ; all except six being in England and Wales.

NOTES OF OBSERVATIONS OF INJURIOUS INSECTS. Report for 1878. By Miss E. A. ORMEROD. 8vo, pp. 27.

The special points of interest are the spread of the turnip fly in localities where charlock was most prevalent ; the effect of rain or dew in diminishing the spread of the pest by reducing its powers of locomotion ; and the observations regarding the destruction of insects by birds.

REPORT OF THE MARLBOROUGH COLLEGE NATURAL HISTORY SOCIETY for the year ending Christmas 1878. No. 27, 8vo.

In an appendix are given daily observations and a summary of the weather, with a meteorological chart for the year 1878.

TRANSACTIONS OF THE WATFORD NATURAL HISTORY SOCIETY AND HERTFORDSHIRE FIELD CLUB. Vol. II. part 8, 8vo.

Contains :—Meteorological observations taken at Cassiobury House, from January to April, 1876, by the Earl of Essex.—Meteorological observations taken at Holly Bank, Watford, during the half year ending 31st August, 1877 ; Report on the Rainfall in Hertfordshire in 1877 ; and Report on Phenological observations in Hertfordshire in 1877, by J. Hopkinson.

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REPERTORIUM FUER METEOROLOGIE HERAUSGEGEBEN VON DER KAISERLICHEN AKADEMIE DER WISSENSCHAFTEN, REDIGIRT VON DR. H. WILD. Band VI. Heft 1, 4to.

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IX. *Dew, Mist, and Fog.* By GEORGE DINES, F.M.S.

[Received January 15th.—Read March 19, 1879.]

FIRSTLY, ON DEW. Although the observations recorded in this paper have a direct bearing upon the causes which lead to the formation of dew, and among them to that more obscure but equally interesting subject—the cold produced by radiation from the surfaces of different bodies, I may at the commencement state my intention to confine my remarks as far as possible to that part of the question which more immediately relates to the amount of dew deposited upon the surface of the earth.

In the last edition of Wells' "Essay on Dew," edited by Mr. Casella in 1866, the following foot note occurs at page 11:—"Various attempts have been made to determine the annual deposition of dew, but without success. To measure the quantity deposited under the most favourable circumstances is no easy task; and, although Mr. Daniell observes that the quantity of vapour existing in the atmosphere in the different seasons, at the level of the sea, seems to follow the course of the mean temperature, such are the varied and uncertain conditions connected with the deposition of dew, that no very accurate results for the average annual deposit can be obtained in the present state of our knowledge. It must, indeed, vary with every climate and every locality. In a general way it has been estimated for England at about 5 ins. annually, which is computed to be about a seventh part of the average quantity of moisture received by the atmosphere in the same time." None of these attempts to measure the amount of dew have come to my knowledge; but of the difficulties I have met with in this inquiry something shall be said hereafter. They are such as to render a correct solution of the question, if not impossible, at all events hi improbable.

The plan which I have adopted in this investigation is as follows Glasses similar to ordinary watch glasses were procured, the surface and the weight of each was ascertained. These glasses were exposed to open air in the evening, being placed on different substances, viz.: grass, on slate, and on a deal board, the two latter being raised a few in above the grass. Part of the deal board was occasionally covered hareskin. A similar board was also placed upon a tower 50 feet above ground. A few observations have been made from time to time on tiles on metallic plates, but of these no notice is taken in this paper. A minin thermometer was generally placed by the side of each glass. To save ti and to prevent loss by evaporation, while the process of weighing was g on, a weight, which exactly balanced each glass when dry, was previously pared, with a mark upon it corresponding to a similar one on the glass. this plan a few small weights only were required, and the weight of deposited upon each glass could be rapidly ascertained.

It will be well at this point to notice some of the difficulties conne with this investigation. In the first place, no results can be obtained any nights during which rain falls, inasmuch as the dew becomes mixed the rain, and any attempt to separate the two may be regarded as hopel On some occasions dew is deposited very copiously in the early par the night, but before dawn a brisk wind springs up, and the dew which been deposited upon the glasses is evaporated.

In cases of mist or fog it is sometimes difficult to determine whether deposit upon the glasses is really dew or merely fine rain. Another diffic which will readily be appreciated, is the necessity at all seasons of the for the observer to be up by sunrise, or at all events before evaporation have set in.

It may be objected that the glasses used in these experiments ra differently from the substances on which they are placed, and therefore do give the amount of dew correctly. I cannot answer this objection ; at pre I do not think any great difference arises from this cause, but it is o the points reserved for future investigation, and can only be determined placing similar vessels, made of different materials, side by side upon same substance.

A consideration of these difficulties, which have now been fairly st soon dissipated the idea once entertained that the dew could be meas morning by morning like the rainfall ; but notwithstanding the obstacles presented, a sufficient number of observations has been accumulate enable me with some confidence to make an approximate estimate as to the annual amount of dew really is.

Before proceeding to the figures, attention may perhaps be called t fact which has no doubt been noticed by other observers as well as by my and that is, the amount of dew (often equal to 0·010 in.) found i measuring glass of a rain gauge ; but it must be remembered that such is deposited upon the interior and sloping surface of the gauge, which exceeds in area the open part, and therefore does not give the quantity correctly, but in excess of the true amount. It is only on rare occasions that an amount of dew exceeding 0·010 in. in depth has been deposited upon my measuring glasses, and out of 198 observations, in only 3 has that amount been exceeded. 58 observations give the amount from 0·010 to 0·005 in.; 107 from 0·005 to 0·001 in.; 22 less than 0·001 in.; and 8 observations no dew at all. These amounts seem small, but their determination really presents no difficulty, as with the balance used for the purpose 0·0001 in. (roughly represented by 0·1 grain in weight) could be determined with the most scrupulous accuracy.

Two out of the three observations mentioned above were taken from off the board on the tower before referred to. One of these was obtained on the morning of December the 15th, 1877, and a detail of that morning's work copied from my books is now given, in order that some idea may be formed of the way in which these observations have been made.

On Tower, minimum temperature in closed stand 30°·6; on board 23°·1; amount of dew in glass on board 0·0105 in.

On Ground, minimum temperature in closed stand 25°·7; on Glaisher stand 23°·3; on ground board 12°·2, and on grass 20°·0; amount of dew on ground board 0·0097 in., on grass 0·004 in.

The remarks in my book with reference to the preceding night are as follows:—"Early part of last night quite bright and frosty. About 8 or 9 a.m. a change came, looked soft and cloudy."

The average amount of the 198 observations gives 0·0038 in. of dew; of these observations 71 made upon grass give an average of 0·0028 in.; and this shows pretty clearly, that the substances upon which the glasses were placed were upon the whole better radiators than the grass. The deal board raised a few inches above the ground appears to be a particularly good radiator. The dew deposited upon the board exceeded that on the tower by about 12 per cent.

If we suppose the dew to average 0·01 in. per night, this would amount to 3·65 ins. per annum. This quantity of dew (although the rain gauge may not be the best of radiators) could never have escaped the attention of rainfall observers, and may certainly be considered in excess of the true amount. Taking the averages of all my observations, and multiplying the result by 365, produces the value of 1·397 in. If the observations on the grass only are taken, the amount obtained is 1·022 in. Looking at these figures, and making a liberal allowance for contingencies, it may I think be fairly assumed that the average annual deposit of dew upon the surface of the earth falls short of 1·5 in.

In concluding this part of my subject, it may be added that the analysis of two years' observations, which the preparation of this paper rendered necessary, reveals anomalies difficult to understand with our present notions of the laws of meteorology. When averages are taken these anomalies are lost sight of, and buried in a mass of figures; but the system of taking

averages cannot be dispensed with, and in this respect I certainly ma
said to live in a glass house and must be careful of throwing stones;
nevertheless I must confess to a strong and growing dislike of the syst
and to a doubt whether it has in reality advanced the science of meteorol
as much as would a more careful study of those observations which, to
narrow vision, appear to set all laws at defiance.

Secondly, on Mist or Fog. These can scarcely be said to differ excep
degree, and perhaps the best definition to be given of either, is that
cloud resting upon, or rather rolling over, the earth's surface. In speal
of mist, it will be considered as one of these clouds on a small scale an
no great depth, while fog extends over a larger area and is of variable de

The temperature of the air near the earth plays a most important part in
production of mist and fog; and to observe this, a light stake has been dri
into the ground with holes bored therein at different heights, into which
upper part of the stems of thermometers were inserted, leaving the bulbs
exposed to the open air. Wood being a bad conductor, any errors ari
from the proximity of the thermometer to the stake must be small, and
be safely neglected.

In early morning, soon after sunrise, the course of a river may be freque
traced by the mist which hangs over its surface, and mist may also be
rising from some parts of the ground. In these cases it has invariably
found that the surfaces of the water, and also of the damp ground
which the mist arose, were warmer than the dew point of the air above th
This makes the cause by which the mist is produced perfectly clear,
the evaporation from the water and the moist ground taking place fa
than the vapour is carried away, the air becomes saturated; but this
not stop the evaporation, the vapour continues to rise into the air, is t
condensed, and forms mist, which gradually spreads over a wider surface

I have not been much at sea, and must therefore speak with some rese
but the neighbourhood of the Gulf Stream, in the higher latitudes, appea
me to be peculiarly liable to fogs of this description. To a similar ag
may probably be attributed the beautiful sight (often seen on a sum
morning) of the mist moving along the valleys, with the tops of the
standing out above it. Many years ago, while standing upon the high gr
near Dorking, with a gentle wind from the north-west, I observed tw
these mist-clouds moving along the valleys, one from the direction of G
ford, the other from Leatherhead. Their outlines were sharply defined,
the front parts almost as upright as a wall; they moved slowly, but majestic
along the valleys, and came into collision at a point where the Box
Station now stands. The effect at the place of collision was probab
slight fall of rain, but all that was visible from my stand-point was
lifting up of the clouds at the point of junction to about double their fo
height. I have, in after years, repeatedly watched these valleys, but I
never been so fortunate as to see two clouds come into collision a se
time.

A curious instance of these mists may sometimes be seen in travelling by railway—the surface of a newly-ploughed field will be covered with mist, while at the same time the air over grass land is perfectly clear. The explanation of this difference is, that the surface of the grass is much colder than that of the newly turned-up ground, and is too cold to allow evaporation to take place from its surface.

Mists of this description are exceedingly dense, but not of long duration; the sun gains increased power, and the water particles of the mist are soon converted into invisible vapour.

The mist last noticed might almost be called the morning mist, in contradistinction to the one now about to be described, which occurs more towards the time of sunset, and may first be seen on a calm, still evening, hovering over the surface of meadow land. On these occasions I have repeatedly taken out my thermometers, and always with the same results; the grass is colder than the air at 4 feet above it (generally from 4° to 6°), and the dew, so to speak, is rapidly condensing upon the surface of the grass.

The general opinion upon this subject is, that the mist rises from the damp grass; but a little reflection will show that this opinion must be incorrect. The vapour of the air is being condensed upon the grass, and it is most unlikely that, at the same time, the grass should be rendering back such vapour to the air immediately above it. In reality, however, consideration will show there is no difficulty as to this. Any substance, liquid or solid, the surface of which is colder than the dew-point of the air by which it is surrounded, will (chemical action excluded) condense vapour upon its surface: and that condensation will continue so long as the conditions of temperature remain unchanged. The condensation on the grass in this case follows a natural law, and under the conditions named no evaporation can ever take place from its surface; the mist therefore above the grass cannot proceed from the surface of the grass itself.

The question at once occurs to us: How is this mist produced? The answer is—the cold on the grass caused by radiation lowers the temperature of the air above it,—the invisible vapour of water previously existing in the air is in excess of that which the air can retain when its temperature is lowered,—the surplus is condensed,—becomes a mist-cloud, and floats in the air just above the surface of the grass.

If this description of mist be watched at its commencement it will generally be found to appear first upon grass land, while a newly-ploughed field, or a large body of water, is perfectly free from it; and in this case, as before, the surfaces of the two latter are warmer than that of the grass, and therefore less liable to cool the air above them.

Mists are most prevalent over low and sheltered places, for the simple reason that there is less movement of the air over such places. The conditions necessary for the formation of mist can scarcely exist when there is much wind, as the air is then kept in constant motion, and the temperatures on the ground and at some distance above it are nearly equal.

Occasions, however, are very rare when no signs of some slight movement in the air are discernible. When such exist, as the mist forms in diffe places, it will be found slowly drifting towards the sides of a field, or ban up against the hedges; in time the mist overtops the hedge, and may be slowly pouring over into an adjoining road, where no mist is forming, by slow degrees overspreading all places alike. The following instanc this may be given :—One evening, driving from Cobham to Walton, on ra high ground amongst the fir-trees, I was surprised by seeing a small p of the road covered with mist; I could see over this, and the road see perfectly clear for the distance of a mile; on coming up to the place, mystery was soon solved—a gap in the hedge had allowed the mis pass out of the field in which it was being formed, and to drift across road into an adjoining wood.

Thus far the conclusions arrived at in this paper, as to the causes which mist is produced, have been based upon numerous observati generally consistent with each other. This has enabled me hithert speak with a confidence amounting almost to certainty; but in entering u the subject of fog, these advantages must be left behind, and I must ask to regard the few suggestions here thrown out on this subject as pu hypothetical.

The two classes of mists which have been described, although diffe as to their origin, extend only over a limited area, and are local in character. Taken either separately or combined, they appear to me to and altogether inadequate to account for those dense fogs which at ti overspread large tracts of country. Dense fogs, near the earth, are accompanied by a clear sky above, when the sun may be seen reflected the gilded vanes of our public buildings. After long consideration, I inclined to attribute these fogs to some cause at present unknown to u which the whole body of the air to some distance above the surface o earth is cooled down, and as a consequence part of the vapour in that condensed, and forms what has been called an "earth cloud."

The observations made at the top of the Kew Pagoda may hereafter t light upon this part of the question, but these have not yet been made pu One of my own observations, which has a rather direct bearing upo subject, was as follows:—At 11 a.m., on the 19th of last November, a was observed extending to about 15 feet above the ground, the sun sh faintly at the same time. There was no difference between the temper of the air near the ground and that at 4 feet above it; but at an elevati 50 feet the air was 6° to 7° warmer.

London fogs are no doubt intensified by the particles of smoke hang alike over all cities; these, being good radiators, become coated wit moisture in the air, and give to these fogs that peculiar colour and which most of us have too often experienced to our great discomfort.

There can be no doubt that mist, fog, and also cloud, are caused by suspended in the atmosphere, but this has seemed so much opposed t laws of gravity that endeavours have been made to explain the anomaly.

The molecules and small particles of water in the air are so minute, they are unable to force their way through the air beneath them ;* they float in that air, like dust in our rooms or particles of smoke in the atmosphere ; yet who doubts that both of these are specifically heavier than the air by which they are surrounded ?

Attempts have been made to measure the size of the molecules of water ; of these no further notice will be taken, but I shall confine myself to my own attempts to measure the size of a dew drop. After trying various substances, such as Canada Balsam, glass and metals, the bright surface of mercury seemed to be preferable to any other. A drop of this substance was placed on the top of a small vessel, and a microscope with a micrometer eye-piece adjusted over it. Water of a lower temperature than the dew point was then passed through the vessel; this cooled down the mercury, and by turning a tap so as to stop the flow of the water, both the appearance and disappearance of the dew could be readily observed. This deposition of dew as seen under the microscope is at all times a most pleasing object, and to those accustomed to the use of high power, and the best means of obtaining light, it promises better results than, with failing eyesight, it has fallen to my lot to obtain.

Another method was to weigh a vessel when dry, the surface area of which was known, and then to find the additional weight when its outer surface was coated with dew. Observations were also made with my hygrometer, by taking the time in which a film of dew disappeared from its surface, when shifted into another place with a different dew-point temperature. None of these attempts were successful, so far as exact measurement is concerned, but the conclusion arrived at was that the drops of dew distributed over a flat surface, and which are plainly visible to the naked eye, do not exceed 0·00004 in. in diameter.

Without entering into the causes which lead to the formation of rain drops, on which some difference of opinion might arise, it will be readily admitted that the particles of water floating in the air must, as they attain a sufficient size, fall to the earth as rain; the size therefore of the smaller rain drops becomes important. This size is not so difficult to determine as that of a

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* Let x be the diameter of a spherical drop of water, and v its vertical velocity. The weight of the drop and therefore the force acting downwards varies as x^3, and assuming that the resistance of the air varies approximately as the surface of the drop, and some function of the velocity ($f(v)$ suppose) conjointly, the upward force varies as $x^2 f(v)$. The velocity v may be considered uniform, because for the short vertical distance considered the density of air and force of gravity are uniform, and an increase of velocity evidently decreases the force which causes the velocity, and a decrease of velocity increases the force.

Therefore the acceleration $= 0$

Or $A x^3 - B x^2 f(v) = 0$

Where A and B are constants

$$A x = B f(v).$$

Therefore $f(v)$ varies as x, and unless when v is small the ratio of v to $f(v)$ is very great, by supposing x small enough we may make the velocity as small as we please.

dew drop. By using the same means, and placing the microscope on the of an open window when fine rain is falling, the size of the drops may readily ascertained. Drops varying in size from 0·010 to 0·005 in. rather common, from 0·005 to 0·0033 in. much less so, and on one oc sion only has a drop smaller than 0·0033 in. been observed. Some of particles of ice which form a snow flake do not appear to be above half size. The largest drop of water I have weighed, and of which I have by t means obtained the measurement, was 0·225 in. in diameter.

The figures here given leave a comparatively large range between the s of dew drops and of rain drops, but this has been partly filled up by othe Kämtz has determined the size of fog particles; while Professor Stok approaching this question from an optical point of view, is of opinion t the drops of water, which formed a corona round the moon, were on occasion 0·0005 in. in diameter.

In conclusion, it may be stated that the greater part of these observatio were made near my residence at Walton-on-Thames, on open grass land, height of 52 feet above Ordnance Datum.

DISCUSSION.

Mr. SYMONS said that the appearance of dew when forming was very beauti He had seen Mr. Dines' operations, and was inclined to agree with all that been said on this point in the paper.

THE PRESIDENT (Mr. GREAVES) observed that the phenomena connected dew afforded the most interesting and instructive knowledge in hygrome The famous essay by Dr. Wells had made his name for ever celebrated, though now nearly eighty years old, still received universal praise. He however, unable to find any passage in that essay where the amount of dew stated to reach 5 ins. annually. The assertion had been attributed to Dr. W by subsequent authors, and he could only imagine it was obtained by multipl some statement of a day's amount of dew by the days of the year. An am of 5 ins. of dew annually would seriously have affected a vast number of returns, and must have, long ere now, come under the direct notice of many observers. He was glad the amount was disputed by Mr. Dines, whose pe verance in a subject requiring such delicacy of observation was most comm able. He thought Mr. Dines' estimate of 1·5 in. annually probably far correct, but he would take even that as a maximum. With increasing atten to hygrometry, the subject would attract closer investigation. The subjec mists over rivers, and many features connected with it, had been instrumen observed, and well treated of by Sir H. Davy in the "Philosophical Transacti for 1819, the leading point argued there being that the water cooled more sl than the ground, and that ground at night became colder than water—tha visibility of mist thence arose, none being apparent when the water was cold when a wind—even a cold wind—was sufficiently dry to carry off the vapou it arose.

Mr. CASELLA said that, when searching for a copy of Wells' book on Dew had such difficulty in procuring one that he resolved to republish it, a believed it to be the highest authority in existence on the subject. The ingen of passing water, cooled to any required degree, below a globule of mercur as to precipitate dew on its surface for microscopic examination, had obtaine highest admiration, and he believed the result to be fairly correct. Whilst Dani hygrometer, when good, was an excellent standard when suitable ether coul obtained, Regnault's hygrometer went further than this, for it enabled the r to be obtained with inferior ether; but Dines' hygrometer permitted this t done with greater facility with water and ice alone.

Mr. **Gaster** said that the object of the paper, so far as it referred to the prevalence and the causes of fogs and mists, was not so clear as could be wished. He took exception altogether to the assumption that "the general opinion" was "that mist rises from the damp grass." Whatever might be the fancies of those who had never studied the question at all, it was certain that the explanations offered by all the leading meteorologists coincided with those given in this paper, as would be readily ascertained by any who consulted the works of Herschel, Buchan, FitzRoy, Kämtz, and others. Herschel, in his "Meteorology," went even a step further than Mr. Dines, and showed how a cold mountain stream was frequently seen covered with a fog or mist, caused, not by its evaporating moisture into air incapable of receiving it, but by its chilling the warm air with which it came into immediate contact, and thus partially condensing the moisture it contained into the form of a fog. In this case the natural coldness of the stream played the same part in the formation of fog as the ground, when chilled by radiation, did in the formation of the "radiation fogs" of spring and autumn. In conclusion, he drew attention to the marked difference between the relative temperatures of the ground and the air during the formation of radiation fogs, and the corresponding temperatures during "wet" fogs—fogs caused by the partial condensation of vapour in a saturated current of air through the contiguity of colder air, whose temperature was lower than the dew-point of the warmer current. In the former case the grass temperature was always much lower than that of the air (in shade), while in the latter it was frequently higher, to the extent of 1° or 2°. The remainder of the paper contained observations of great importance, and showed signs of great care on the part of its author.

Dr. **Tripe** stated as his opinion that in dense fogs the soot surrounded the water, and not the water the soot, and that these, intermixed with the impure and irritating acids evolved during the burning of coal, and held in solution by the watery vapour of the atmosphere, were the causes of the peculiar taste, colour, and smell which characterised London fogs.

Mr. **Marriott** said that his observations quite confirmed Mr. Gaster's remarks. He had placed thermometers—(1) on the grass, (2) on forks, with the bulb level with the top of the grass, (3) 3 ins. above the ground, (4) 1 ft. above the ground, and (5) 2 ft. above the ground. With a dense white fog in the morning, the thermometer on the grass read occasionally 6° higher than that with the bulb on the top of the grass, there being but little or no difference between the latter and the other thermometers up to 4 ft. Colonel Ward, at his request, had taken some observations of the dry and wet bulb thermometers *in* and *above* clouds on the mountains in Switzerland. The following observations were made in the ascent and descent of a mountain starting from Rossinières:—

1877.	Nov. 17th.		Dry.	Wet.		Objects invisible at
Châlet 10.30 a.m.		....	31°·6	31°·3		
40 feet up.		Just under cloud	32·2	31·7		
90	,,	Just in cloud ...	32·2	32·0		20 yards.
200	,,		31·6	31·5		10 ,,
300	,,		31·5	31·4		7 ,,
400	,,		31·5	31·4		4 ,,
500	,,		31·1	31·1		2 ,,
600	,,		30·0	31·6*		2 ,,
700	,,		30·6	31·3*		2 ,,
800	,,		31·3	31·5*		2 ,,
900	,,		30·6	31·4*		1½ ,,
1000	,,		31·0	31·6*		5 ,,
1100	,,	Just in	31·3	31·5*		5 ,,
1130	,,	Just out	32·0	31·8	Brilliant Sunshine.	
1200	,,	11.15 a.m.	35·3	32·5		
1240	,,	11.50 ,, ...	39·0	35·0		
1130	,,	Just out	37·3	35·5		

* Connecting thread frozen, and water partly so; muslin wet as at starting, but not frozen.

		Dry.	Wet.	Objects invisible
1100 feet up.	Just in…………	31°·3	31°·0	70 yards.
1000 „		31·0	31·3	60 „
900 „		30·3	30·3	30 „
800 „		30·3	30·3	40 „
700 „		30 3	30·3	40 „
600 „		31·3	31·3	30 „
500 „		31·3	31·3	30 „
400 „		32·0	32·0	50 „
300 „		32·0	32·0	70 „
200 „		32·2	32·2	80 „
90 „	Just in…………	33·0	32·8	100 „
40 „	Just out ………	33·3	32·8	
Châlet 12.15 p.m.	……………	33·5	33·0	

He (Mr. Marriott) had placed two thermometers on a board, half of which
painted white, the other half being unpainted, and found that there was scarce
any difference in their indications, the thermometer on the unpainted part bei
possibly only a few tenths lower than the other.

Mr. WHIPPLE said that, as the water forming dew was precipitated fr
its gaseous state, it would be necessarily pure; hence the size of the dewdro
at the instant of their formation would be that of the molecules of water,
this, depending simply upon the size of the component atoms, could be read
determined by the method suggested, he believed, by Sir W. Thomson. But
any case, as Mr. Dines had truly remarked, they were too small to be seen,
the subject did not require further discussion. Dew to the amount of ·01 in.
not often observed at Kew; probably the surface of the rain gauge used th
(enamelled iron) affected the deposition. He would be glad to hear of a ca
suggested for the sharp vertical face to a fog, which Mr. Dines had observed
well as himself. His impression of Dr. Frankland's theory of dry fog, recen
published in the 'Proceedings of the Royal Society,' was rather that the w
particles became coated with oils deposited from volatile hydro-carbons in
smoke, rather than with soot.

Mr. LAW remarked that on one occasion he was on board a steamer, ab
twenty-five miles off Rio de Janeiro, when it suddenly, and without any warni
passed into a fog of so dense a character that the course of the ship had to
completely changed, for fear of running down another vessel which had b
observed a short distance ahead.

Mr. STRACHAN stated that although it was not possible to define where a
ended and a fog began, it was certain that both arose from a similar cause ac
on the humidity of the air—namely, difference of temperature, and it was q
indifferent whether the warmth came from above or below the cold. In the Ar
Regions, so long as the sea was frozen over, there were neither mists nor fogs;
immediately cracks or openings formed in the floe, "water smokes" arose,
ducing dense mists and even fogs.

Mr. DINES said that Mr. Casella had half apologised for re-publishing We
book. He did not think any apology was necessary; on the contrary, Mr. Cas
deserved the thanks of the Society for having done so. Other books on mete
logy gave the annual amount of dew as 5 ins. The optical powers he had u
in his experiments were about 30 and 100 diameters, but the difficulty was
the light for the higher powers. The drops formed by breath upon the merc
were large compared with dewdrops, and the size could be easily ascertai
He thanked the Society for the manner in which his paper had been received

X. *On the Inclination of the Axes of Cyclones.* By the Rev. William Clement Ley, M.A., F.M.S.

[Received February 4th.—Read March 19th, 1879.]

A scientific hobby is excusable in those cases in which an idea represents the results of many years' work, if the materials of that work are not easily accessible, or have not attracted general attention. I trust, therefore, that I shall be pardoned for bringing the subject of the present paper a second time before this Society, in the hope that the discussion to which it may give rise will lead to some valuable expressions of opinion. In this paper I simply wish to call attention to the evidences recently afforded by the results of mountain observations to the theory that "the axis of a cyclone inclines backwards." Before proceeding to mention these evidences it will be desirable briefly to review the state of the question up to the present time; I shall then be able, to my own relief as well as to that of my hearers, to pass from my own investigations to those conducted by a great student of meteorology in America.

From *à priori* considerations relating to the possible effects of the friction of the earth's surface upon the currents of the atmosphere, the belief was until the last few years almost universally entertained that the changes of atmospheric pressure represented by the passage of cyclones and anti-cyclones take place earlier in the higher strata than in those contiguous to the surface. Some colour was given to this belief by the fact that changes of temperature not unfrequently occur at an earlier hour upon the summits of hills than at their bases, the inference that changes of pressure do the same being far from unreasonable. In 1872 I tried to direct the attention of meteorologists to the fact that observations of the upper clouds furnish a result diametrically opposed to the belief of which I have spoken.[*] In 1874 Professor Hildebrandsson contested the accuracy of this conclusion in an essay deserving of much consideration.[†] Meanwhile the further collection and examination of my data had converted my previous belief into the strongest of subjective certainties. Accordingly, in 1875 I addressed a letter[‡] to Professor Hildebrandsson stating the results of my later studies. I may be allowed to quote a few sentences of that letter, since by doing so the necessity for a more detailed explanation of certain points bearing on our subject will be obviated. I mentioned that in the majority of cases "an upper current lay over the depression centre, which upper current was nearly in accordance with the current previously experienced at the earth's surface; *e.g.* in a depression travelling to N it was from some south-easterly point; in a depression travelling to E, from a S or SW point. Thus the

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[*] 'Laws of the Winds prevailing in Western Europe,' pp. 156-162.

[†] 'Essai sur les Courants Supériéurs de l'Atmosphère dans leur relation aux lignes isobarométriques.'

[‡] 'Symons's Monthly Meteorological Magazine,' Vol. X., pp. 92-93.

westerly wind in the former case, and the northerly in the latter, appea
to occur in the lower regions of the atmosphere before they reached t
higher. Similarly, in several instances in which an anticyclone has follow
in the immediate wake of a cyclone, I have noticed a N or NW upper curr
to exist over the central calm of the anticyclone."

I also stated that "it was this phenomenon that was one of the fi
things which led me to adopt the conclusion (which I still believe to
correct) that the eastward motion of our depressions is not so much due
the prevailing force of the westerly currents acting as a *vis à tergo*, as to
fact that the depression perpetually *reproduces itself* to the eastward of
former position, such reproduction being due to changes of tension tak
place primarily in the lower strata. To this theory your remark, that fricti
will retard the motion of the inferior part of the depression, does not appl
to any other it would.

"Although, however, I believe that the central calm of a depression
the earth's surface is in advance of the corresponding calm in the hig
regions, it appears to me that the whole disturbance or circulation of air
frequently of greater extent in the higher than in the inferior region. C
sequently, when a depression is approaching, even though its axis incli
backwards, the banks or belts of cirrus, travelling from SW, W, or NW, m
frequently be observed overhead a little *before* the S or SE wind has co
menced on the earth's surface."

In the summer of 1877 appeared Professor Hildebrandsson's "Atlas
Mouvements Supérieurs de l'Atmosphère." In that paper he stated
inability, in the very extensive investigation which he had made, to tr
distinctly the law which I had indicated relative to the axis of a progress
cyclone. His words are as follows:—"This does not commonly take pl
at Upsala. We have not been able to find in the Monthly Meteorologi
Bulletin of the Upsala Observatory for 1874 and 1875 more than two ca
8th to 9th March, 1874, and 11th November, 1875, where this fact may
exhibited after a barometric minimum below 745 mm. (29·33 ins.)
passed, and the wind has, at the same time, veered as above stated.
our own part, we have not therefore succeeded in finding any very deci
proofs in favour of the views of the English meteorologist, although we
pleased to recognise that cases present themselves in which the axis
inclined as he maintained."*

Shortly before the publication of this second paper of Professor Hil
brandsson's, I had communicated to this Society the results of an examinat
of 2,194 observations of the movements of cirrus, made in the differ
segments of progressive circular and nearly circular cyclonic areas.†

I had also in another letter‡ implored the attention of observers of weat to conditions of not uncommon occurrence in which it is easy to test the accuracy of the law. Whether any one has taken the trouble to apply the tests, I have never been able to learn.

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* 'Atlas des Mouvements Supérieurs de l'Atmosphère,' p. 10.

† 'The Relation between the Upper and Under Currents of the Atmosphere,'
Quarterly Journal Meteorological Society, Vol. III., p. 437.

‡ 'Symons's Monthly Meteorological Magazine,' Vol. XII., p. 73.

I need repeat no portion of the matter contained in my last paper; but I must continue for a few moments this necessarily egotistical part of my present contribution. Up to the present time I have continued the discussion of upper-current observations to the best of my power. Those obtained since the date of my last paper, that is to say, the mean angles in the several segments of the depressions, as obtained from the later combined with the earlier data, agree almost exactly with those obtained from the earlier alone. I have, however, been principally engaged in obtaining the values of the mean angles of the upper currents, and of the surface winds around anticyclonic areas. The investigation is necessarily prolonged from the paucity of upper-current observations in these areas in the winter season and by some other circumstances. I need not anticipate its conclusions, except as regards one particular. The movements of anticyclones do not seem to be inherent in the same sense in which we may attribute that quality to the movements of the cyclones; that is to say, anticyclones either possess no power of self-propagation over the earth's surface, or if they possess any, the laws to which it is related are not at present intelligible. When an anticyclone, or what may be regarded as an imperfectly formed anticyclonic area, viz. a ridge of relatively high pressure existing between neighbouring depressions, moves over the earth's surface, its motion, so far as we have yet been able to discover, simply results from, or represents, the movement or progressive self-propagation of the areas of depression in its vicinity. We should therefore expect, and we have almost invariably found, that the inclination of its own axis is related to and corresponds with that of the axes of the neighbouring depressions. From this it follows that in these cases the barometric maximum in the higher regions of the atmosphere lies in the rear of the maximum observed at the earth's surface, precisely as we have found the minima in the higher regions to exist in the rear of the minima in the lower.

I have previously pointed out that the isobars for the level of the cirrus, hypothetically constructed from the directions of the currents, indicate that in the front of a cyclonic system (which is commonly the district of greatest condensation of moisture in the inferior atmosphere), there exists in the higher regions a " ridge " or wave of atmosphere whose pressure is high in comparison with that of the atmosphere, at the same level, on either side of it. A line drawn from the summit of this " ridge " to the nearest point in the ridge or wave of maximum pressure at the earth's surface existing between consecutive cyclones, will have much the same angle of inclination to the surface as the axes of the cyclones themselves.

I may add that the exterior edge or slope of the ridge in the elevated strata (viz. that furthest from the cyclone centre) is usually marked by the exterior edge of a bank of cirrus. Without entering further into the subject of cyclone theory here, we are, I think, justified in inferring that this edge represents the line along which the mass of atmosphere carried upward and outward through the liberation of latent heat in the district where cloud and rain are formed begins to descend again towards the earth's surface; the wave of high pressure at the earth's surface, further in front of the cyclone, marking the district towards which these descending currents flow.

I think that every meteorologist, whatever his opinion on the subject before us may be, will agree with me when I say that the question of the accuracy or inaccuracy of the law above indicated is one of considerable scientific importance. It faces us whenever we attempt to investigate theoretically the causes of the movements of cyclone and anticyclone to which our changes of wind and weather are related, and it demands solution before any theory on this subject can be regarded as having a completely satisfactory basis.

We should expect barometrical and anemometrical observations carried on simultaneously at the summit and base of a mountain to furnish valuable evidence either for or against the law of which we are speaking. If the axes of the atmospheric rotations are inclined, so that we readily trace this inclination as it is mapped out for us in the movements of the clouds, and if the inclination bears any relation one way or the other to the direction in which the whole circulation is moving forwards, then we shall anticipate some recognition of this relation in the records of the mountain observatories.

We have not had to wait long for this kind of evidence. It has been given us in Professor Loomis' latest "Contributions to Meteorology."*

The first part of the paper to which I refer is occupied by an examination of the Storms of the Atlantic Ocean, which will be welcome, I believe, to every one who has devoted any real study to the subject of the American storm-warnings, but which it would be irrelevant to discuss here. Professor Loomis then proceeds to discuss the fluctuations of the barometer and directions of the winds at the summit (elevation 6,285 ft.) and base (2,898 ft.) of Mount Washington during May and June, 1878; also the transit of barometric minima as observed on the summit of Mount Washington, and at Burlington and Portland, from September, 1872, to January, 1875. He next compares the observations made at the summit of Mount Mitchell, in North Carolina (6,691 ft.), with those made at the base of the mountain (2,560 ft.) for the short period of one month. He afterwards compares the dates both of maximum and minimum pressure observed on Pike's Peak (13,960 ft.) with those made at Colorado Springs (the base of the mountain 5,880 ft.). The comparisons speak with one voice. The observations on Mount Washington, as compared with those at Burlington and Portland, indicate an average retardation in the passage of the minima for one hour for an elevation of 1,600 ft. Those made on Pike's Peak give an average retardation of one hour for an elevation of 1,380 ft. The author concludes from these calculations "that over the United States both the maxima and minima of atmospheric pressure generally occur first near the surface of the earth, and they occur later as we rise above the surface, the retardation amounting to one hour for an elevation of from 900 to 1,300 ft." Thus far the results of mountain observations in America are readily compared with the results of cloud observations in Europe. The conclusions at which Professor Loomis has arrived, from his examination of the winds at mountain stations, cannot so easily be compared with those same results. I have previously shown that but little can be made of cirrus observations, unless regard be had to the directions in which the centres of low pressure are progressing at the times when these observations are made. In describing the relation of high winds on Mount Washington and on Pike's Peak to the centres of areas of high and low pressure observed at lower levels, Professor Loomis considers the disposition only of these centres, without particular regard to their direction of development. It would be desirable to supply this latter element; but I regret to say that I have been unable, through want of time, to do so. It is, however, a known fact that the average direction of storm-paths across the northern portion of the United States is a few degrees North of East, though the instances in which the path of a depression has widely deviated from this direction are plentiful enough. Making, in regard to our conclusions, due allowance for this variability, we will suppose the centres of low pressure to which the winds on Mount Washington and Pike's Peak were related to have been travelling to the east. We can thus roughly compare the mountain winds examined by Professor Loomis with the results of our own upper-current observations, if we suppose the European depressions, from which the mean angles of the cirrus-currents have been calculated, to travel similarly from west to east.

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* 'American Journal of Science and Arts,' January, 1879.

In the columns on page 172 I have, on the supposition just explained, contrasted the variations of the mean angles of the European upper-currents with the radius—*i.e.* with the position of the centre of low pressure at the earth's surface, as already shown in my diagram (Quarterly Journal of the Meteorological Society, October, 1877), with the corresponding angles of the high winds on Mount Washington, examined by Professor Loomis, describing the latter in his own words.

It will be as well to add here, in Professor Loomis' words, the conclusions which he considers his examination of the high winds on Mount Washington to warrant. "1. High winds on Mount Washington circulate about a low centre, as they do near the level of the sea. 2. The motion of the wind is nearly at right angles to the direction of the low centre. 3. The low centre at the height of Mount Washington sometimes lags behind the low centre at the surface of the earth apparently as much as two hundred miles."

From his examination of the high winds at Pike's Peak, Professor Loomis concludes that "at the height of 14,000 ft. the fluctuations of the barometer are quite large, but the centres of low pressure at this elevation differ in position from those at lower stations, and we frequently find areas of low pressure resulting from a circulation of the surface-winds which does not extend to the height of 14,000 ft." I may here observe that 58 per cent. of the winds from which the last conclusion is drawn occurred in the colder months; and I have already remarked that "in winter very local depressions,

Direction.	Upper currents as shown in Diagram.	High Winds on Mount Washington.	High Winds on Pike's Peak.
Northerly ...	About 93°. Very little variation.	Nearly at right angles to the direction of the low centre.	Generally an area of low pressure on the E side of the Station.
N. Westerly	About 96°. Centre usually further to W. than in the instances of the N. upper currents.	Average nearly at right angles. Centre in ⅓rd of the instances further to W than in the instances of the N winds.	Area of low pressure generally on the NE side of the Station.
Westerly ...	Varying much, from about 40° to about 140°.	Angle with direction of Station reporting least pressure ranges from about 0° to somewhat over 90°. On account of small number of Stations, it is generally impossible to assign exactly the position of the centre of least pressure, but apparently the angle which the wind's direction made with it was in some cases less than 45°.	Area of low pressure generally in a NE direction.
S. Westerly	Position of centre varies from about NNE to about WSW. (SW upper currents occuring in districts E. G. I. K. and J.)	Direction of Station reporting lowest pressure ranges from N 25° E to S 75° W, the average direction of the low centre making an angle of about 90° with the direction of the wind.	Area of low pressure generally in a N direction.
Southerly ...	Position of low centre usually SW of Station.	Low centre generally found nearly W from station. 4 exceptions out of the 14 instances.	Area of pressure generally in a N direction. Frequently the centre appeared to be in a direction east of N. (Deficiency of more Westerly Stations of observation.)
S. Easterly	Centre usually about SSE or S by E.	Low centre falls between the directions S and NW. One exception out of the 13 instances (a case which seems to indicate that at the height of 6,000 feet, the low centre was nearly 200 miles in arrears of the low centre at the surface of the earth.)	Generally an area of low pressure at no great distance, but in half of the cases, the lowest observed pressure was on the NE side of the Station.
Easterly......	Centre usually about SSE or S by E.	Low centre generally found nearly S of Station. 4 exceptions out of the 14 instances.	Pressure on Pacific coast generally somewhat less than 30 ins., while on the E side of the Station, the pressure was a little greater than 30 ins., but at Santa Fé the pressure at these dates was not sensibly below the mean.

even when deep, scarcely affect the direction of the cirrus-currents in their vicinity."

When due allowance has been made for the difference of principle already mentioned, on which the two classes of observations were examined, and when, further, we bear in mind the important fact that the altitude of the mountain observations is not the altitude of the cirrus, and that the pressure and wind variations at the former height can only be expected to be intermediate between those observed at the ordinary stations and those which determine the movements of the upper clouds, there remains an amount of agreement in the results of these two classes which can scarcely be accidental; for it will have been noticed that this agreement is most distinct precisely in those regions in which each class of observations yields the most reliable conclusions. It is in the right hand, *i.e.* most usually in the southern half of the cyclonic systems, that we obtain the great majority of our upper-current observations. Now, it is these northerly, westerly, and south-westerly upper-currents, whose angles with the depression radius coincide so remarkably with those of the same winds at the mountain observatories. In the left hand, or northern half, the European upper-current observations are more scanty. Similarly in this latter half Professor Loomis is driven, in order to obtain his results, to employ very light winds, the instances of the winds occurring in this half being comparatively rare. Thus, in order to obtain thirteen instances of an east wind on Pike's Peak from a period of fifteen months, for comparison with eighteen instances of west wind, he has to take all east winds of seven miles per hour and upwards as against west winds of fifty-five miles and upwards. And it is in this last half, where the materials are least satisfactory, that the results in the two classes least accord.

It would have been a useful addition to this paper if I could have added an analysis of the wind and pressure observations at the French mountain observatories. But this task must be deferred. One remark, however, must be made, as it refers to the only published statement which I have yet seen bearing upon this particular part of the subject. M. Alluard, in his note to the Academy of Sciences on "The Variations of Atmospheric Pressure at Different Altitudes, ascertained at the Observatory of the Puy de Dôme during the Storms of the Winter of 1877,"* remarks that in the storm of the 28th to the 31st of January, between 4 and 8 p.m. of the 30th, the barometer fell from 726 to 723 mm. at Clermont, while at the Puy de Dôme it oscillated about 634 mm., with a range *(écart)* of 0·5 mm., and that afterwards it resumed its upward movement one hour earlier there than at Clermont; also that "the storms of the 18th to the 22nd of February, and of the 7th to the 9th of March, have given similar results." These remarks appear to indicate that the depressions above mentioned were, in that district, confined to the inferior strata of the atmosphere. However, M. Alluard's note contains one diagram exhibiting the variations of atmospheric pressure from the 3rd to 7th January, 1877. This diagram shows, with sufficient distinctness, the retardation of the larger fluctuations on the summit as compared with those at the base, obscured, as the former to some extent are, by the lesser oscillations which form so remarkable a feature in these observations.

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* 'Comptes Rendus,' Vol. LXXXV., p. 529.

I am not sure whether the results of the mountain observations referred to in this paper can be regarded as absolutely proving the truth of the theory that "the axis of a cyclonic circulation is inclined so that the centre of the circulation at the earth's surface is in advance of that in the higher regions." But I am sure that these results impose upon the opponents of this theory a task to be undertaken with alacrity—viz. that of explaining, on their own hypothesis, the substantial accordance in the results of very different systems of observations.

On concluding this paper I ought, perhaps, to apologise—firstly, for the liberal use of the first personal pronoun; and, secondly, for a certain tone of challenge which I have adopted. My apology must be, that I could avoid neither. In regard to the first point, it may be remembered that I long ago insisted, though ineffectually, upon the importance of the results likely to be obtained from upper-cloud observations, and the consequent undesirability of this work being left so completely in the hands of a small corps of volunteer observers. In the second place, under the circumstances, if the axis-inclination comes to be regarded as an established fact, I think it but fair to claim, in behalf of cloud observation generally, and of these observers in particular, a priority of discovery on the subject. Considering the peculiarities of that subject, we cannot be surprised if those who occupy the summit of the meteorological mountain are disposed to hesitate in accepting the conclusions of those who are only at its base. As a representative of the latter, I will say that we shall watch the opinions of the former with interest, anxious to discover whether these begin to exhibit any tokens of a diminution of pressure in regard to their opposition to the theory that "the axis of a cyclone inclines backward."

DISCUSSION.

Prof. E. D. ARCHIBALD, in a letter to the SECRETARY, said:—Taking the phenomenon of the inclination of the axes of cyclones and anticyclones to be established as far as was necessary for a working hypothesis, it was possible to account for a part thereof by the difference in the rotational velocity of the air at different heights above the earth's surface, assuming, as usually allowed, that a cyclone-axis was the region of ascending, and an anticyclone-axis of descending, air. It would be an easy matter to show that a mass of air, ascending from near the surface of the earth to some loftier stratum, would be retarded by this cause alone in the direction of rotation by an amount proportional to the time occupied in ascending. As this latter was at present an undetermined factor, the amount of retardation in the direction of rotation could not at once be found. A similar retardation should take place in the case of air descending, as it was assumed to do, down the axis of an anticyclone—that was, both cyclone and anticyclone above should occur W of those below. Now, in the cases upon which Mr. Ley based his hypothesis, most of the storms travelled from some westerly to some easterly point; consequently, the retardations mostly occurred in the direction of rotation. He spoke, however, of some storms which travelled from E to W, and in which the same backward inclination was noticed. Professor Archibald would ask whether, in these cases, the inclination was as noticeable as in the others ; or, if less in amount, by how much? Evidently here was a crucial test of the value of his suggested partial cause. If the inclination, in the case of storms travelling from E to W, was precisely equal to what they were when travelling in the opposite direction, then his cause must be abandoned as an effective factor in the result. If, on the other hand, the inclination was less in the former case, the defect should, theoretically, be exactly double of that portion of the whole phenomenon due to difference of rotational velocity alone. Perhaps Mr. Ley might be able to give some facts either to disprove or else confirm the efficient aid to the observed inclination of the axes of cyclones and anticyclones rendered by the cause suggested. He only claimed a small portion of the retardation to be due to the above cause, and this only in the direction of rotation ; but, if such a view was ultimately confirmed, it would leave less of the phenomenon to be accounted for by the action of other causes. To account for an entire lag of 1 hour per 1,300 ft. in a westerly direction by the action of this cause, supposing storms to travel at the average rate of 15 miles per hour, it would have to be assumed that air takes 205·5 hours in ascending to this height at the Equator, and 380·1 hours in lat. 51° 28′ (Geocentric), suppositions evidently very far removed from probable reality.

Mr. **Laughton** said that to him the interest of the paper lay principally in its suggested bearing on the theory of the onward movement of cyclones. The inference which it led to was that the backward inclination of the axis was incompatible with the idea that a cyclone was of the nature of an eddy in a great atmospheric current; and would, on the other hand, give a strong support to the theory of which Mr. Ley was a prominent advocate, that the advance was rather a continual re-production. He was, however, inclined to doubt the correctness of this inference. He knew, indeed, that it had been very generally accepted, that if the advance was due to the cyclone being carried on in the main stream, its axis must be inclined forward ; but, on consideration, he did not see that there was any "must" in the matter. The idea of such a forward inclination implied, of course, a tilting forward, such as would undoubtedly occur if a column of small diameter were dragged along on the ground. But a cyclone was in no sense a column. Its height, relatively to its diameter, was insignificant. It was, in fact, fashioned on the lines of a pancake, not of a lighthouse ; and any such tilting forward as had been suggested was, he conceived, impossible. If this was the case, the only way in which the axis could incline forward would be by the superior strata being driven on, sliding, as it were, over the inferior, which were retarded by friction. This was probable enough, but he could not see that it must necessarily be so. He could easily imagine that an eddy, carried forward in the current, left a tendency to a vacuum in its rear, and that the axis might incline backwards towards this. He could conceive that such a tendency to a vacuum might cause, or at least strengthen, that downward current which Mr. Ley thought he had detected in the hinder half of the cyclone. He had often heard it said that the proof of any inward or outward, or ascending or descending, motion would be fatal to the idea of the cyclone being an eddy; would be, in fact, a conclusive proof that it was the inrush of air round an area of low pressure. This he could not admit. A whirl caused mechanically, in a limited space, would show all these motions. If some water in a tumbler was stirred briskly round, every one of them would take place. If any dust that would float in (not on) the water—as, for instance, grated nutmeg—was mixed with it, the currents could be easily observed. Whilst the main current went round and round, there were also minor currents, upwards in the middle, downwards at the circumference, inwards at the bottom, outwards at the top ; and as the water came to rest, the dust—the nutmeg—would range itself in a fine pointed cone in the middle. Such a system of minor currents he could well conceive taking place in a cyclone, even if produced mechanically by the clash of intrusive winds ; and he could believe that the downward current which Mr. Ley had described might be so caused, intensified by the attraction of the vacuum he had already spoken of. He did not now say that cyclones were or were not such mechanical eddies ; he thought that, when the truth was established, it would be found to lie somewhere between the opposing theories ; but, meantime, he had no hesitation in saying that the observations now brought forward by Mr. Ley, even if confirmed to their fullest extent, did not, of themselves, confirm or upset either of these theories ; and that, before any conclusion could be laid down dogmatically, very many more observations, and very many more data, were still needed.

Mr. **Gaster** said that the position taken up by Mr. Ley appeared to be briefly this :—"During the passage of cyclones over any given position, certain phenomena were observed in the movements of the cirrus cloud, and others in the variations of atmospheric pressure at different altitudes, in explanation of which the theory of the backward inclination of the axes of cyclones was proposed. Now it was known as a fact that cyclones had a calm area as the centre of the cyclonic (or, rather, the spiral) whirl, which was also the region of lowest pressure at the earth's surface ; and, if there was any truth in the most generally received theory of the nature of cyclones, the air ascended around or in that central area from the lower to the upper strata. What was submitted was that this central area represented the base, not of a vertical, but of an inclined axis, which leant backwards—*i.e.* in a direction the opposite of that in which the cyclone was travelling. If this were admitted, the phenomena observed were at once explained ; but if denied, it must be left to those who denied it to furnish a better explanation." No doubt this was a decided stand to make, and it was refreshing in the present day to find any one speaking decidedly at the same time that he proposed an intelligible explanation of any meteorological problem; but the position was also strong, and was more difficult to "turn" than appeared at first sight. If, however, it was true, then Mr. Gaster urged that it did much to confirm the accuracy of an opinion which he had advanced on a former occasion viz. that the differences observed between the directions taken by the cirrus clouds in advance and those in the rear of a depression were more apparent than real ; being due to the fact that the air, while rising in or about the axes of a storm, acquired, to some extent, its onward motion ; and that, if the effect of that motion were eliminated, it would be found that the outward motion of cirrus from the upper end of the axis would appear as uniform and regular in its direction as the inward motion of the surface currents at the base. In all this, however, he assumed the diagram illustrating the motion of cirrus clouds to be accurate.

Mr. **Strachan** said that the object of the paper was to adduce evidences of a theory that the axis of a cyclone inclined backwards. Formerly a theory was broached that the axes of cyclones inclined forwards ; but that had not been generally accepted. It was accounted for by the friction of the air currents upon the earth's surface, whether sea or land ; and Ferrel, the American mathematician, claimed friction as a very important element in the investigation of atmospheric movements. Mr. Ley, however, said that friction did not apply to his theory, though he did not explain why. Whatever might be the merits of the theory, so far as it depended upon the author's own investigation of cirrus cloud and upper currents of the atmosphere, it seemed that the evidence which he now brought to its support from mountain observations proved too much. For instance, he said, "The observations on Mount Washington, as compared with those at Burlington and Portland, indicate an average retardation in the passage of the minima for one hour for an elevation of 1,600 ft." Taking 20 miles an hour as the progressive rate of a cyclone, by no means a large assumption, here, in a vertical height of a little more than a third of a mile, was a horizontal lagging of 20 miles, a ratio of 1 to 60, which gave an angle from the vertical of 89° for the backward inclination of the axis. Again, he stated : "The low centre at the height of Mount Washington sometimes lags behind the low centre at the surface of the earth apparently as much as 200 miles." Here the thing was greatly exaggerated, and a nearer approach to horizontality of the axis was attained than even 89° ! This was piling Pelion upon Ossa. They did not fit ; the structure toppled over. The diameter of a cyclone might be as much as 1,000 miles. Loomis wrote : "We frequently find areas of low pressure resulting from a circulation of the surface winds which does not extend to the height of 14,000 ft.," or less than 3 miles. Consider, then, a smaller cyclone extending even higher, say 500 miles in diameter and 5 miles high. Represented by a disc 10 ins. in diameter, the thickness of such a cyclone would be only ·01 in. ; so fancy the axis inclined 89°, if it were possible ! The whole paper, in his opinion, was too wordy—

> "Evasions vain
> And reasonings, though through mazes, lead me still
> But to my own convictions ;"

and one could only think that such evidences gave the paper a claim to be classed among the "curiosities of explication," and even the author's subjective certainties must grow weak by their effect.

Captain **Toynbee** said that Mr. Ley's paper brought together a large number of facts which threw much light on the action of cyclonic systems, though more data were wanted before any theory respecting them could be said to be proved. There must be some great force at work, which drove the air from the west over Mount Washington at an average speed of 50 miles an hour during the winter, and at a speed of nearly 30 miles an hour in the summer. He hoped that this paper would induce many more observers to record the motion of upper clouds, stating the direction from which they came, and their apparent height and speed. He thought that much praise was due to Mr. Ley for so good a paper on so important a subject, and hoped that he would continue his researches until the whole truth was elicited.

Mr. C. **Harding** thought too much reliance should not be placed on the observations which at present existed for a comparison of the passage of high and low barometric pressures at different levels. He did not think that the American observations quoted in the paper supported the theory to the extent that Mr. Ley supposed. Out of the four European observations entering into the paper, three were taken as exceptional cases, while the fourth might be used about as much against the inclination theory as in support of it.

Mr. **Whipple** observed that whirlwinds were always represented as leaning forward, and he supposed that cyclones were similar phenomena on a greatly magnified scale. He considered it more probable that the axis inclined forward. The barometer trace for the Puy de Dôme appeared to be violently disturbed by the wind; and, therefore, it was hardly good evidence to base deductions upon. He would like to know whether account had been taken of the rate of progress of the cyclone along the horizontal line between the two American stations, and also whether Mr. Ley could explain why there was occasionally an abrupt change of 180° in the direction of the wind after a cyclone-axis passed over a place.

The Rev. W. **Clement Ley** did not propose, for the present, to follow some of the previous speakers into the more abstruse problems of aero-dynamics involved in the mechanics of a cyclone. A misconception, however, appeared to him to underlie some of the remarks which had been made, especially those of Mr. Strachan—a misconception to which it was possible that the use of the expression "axis," as applied to a cyclone, had contributed. He had adopted this expression for the sake of brevity, not having apprehended that it could lead to the idea that the "axis" of a cyclone was a substantial cylinder—a body separate from the cyclone itself. Apparently, considering the axis as an independent column or stream of air, it was not unnatural that Mr. Strachan should regard the supposition of such a column preserving its continuity, when several hundred miles in length and inclined very nearly 90° from the vertical, as an absurd supposition. But by the "axis" of a cyclone was really intended only that region within the limits of a cyclonic circulation in which the barometric gradient was zero; in other words, that area in which the isobaric plane was coincident with the horizontal plane. (He called it a region, or area, because, although theoretically it might be simply a point in the horizontal plane, yet practically it was always a district of considerable extent.) He had contended — and, he believed, proved—that when a cyclone was propagated over the earth's surface, the area referred to, being successively produced in the different atmospheric strata, occupied at each moment a different geographical position at different levels, and at a considerable elevation lagged greatly behind the corresponding area at the earth's surface. It was fundamentally wrong to regard the axis of a cyclone or of an anticyclone simply as a vertical current surrounded on all sides by horizontal currents. The axis was not itself a current at all; and the exterior currents had vertical components, although their horizontal components only could be observed and registered—*e.g.* in his opinion, a brisk upward movement of air took place in the winds which formed the front, or advancing portion, of a cyclone. He was obliged to differ from what Mr. C. Harding had said as to the American observations. He should also leave M. Alluard's diagram to indicate what he still believed that it did indicate—"the inclination of axis." Its item of testimony was valuable precisely because it was unconscious, the diagram having been constructed with no view to this question. Several speakers seemed to assume that the present paper was intended as a prop

to the condensation theory of cyclones. What the paper had done was to
out a law, of which it was very possible, though not certain, that the condens
theory would eventually furnish the explanation; but which, meanwhile, r
on no theoretical basis whatever. In reply to a question from Mr. Gaster, w
remarks he thought very valuable, he would say that it was the large and
formed depressions, as opposed to "secondaries" and subsidiary systems
inclination of whose axis was, in general, the most distinct. In reply to
Whipple, he would state that, although in the higher regions of the atmos
the whole cyclonic circulation appeared to be more extensive, generally spea
than at the earth's surface, the area of central calm was frequently, as c
observations seemed to demonstrate, more extensive at the lower than a
higher levels.

XI. *Contributions to the Meteorology of the Pacific, No. III. Samoa*
Navigators Islands. By ROBERT H. SCOTT, M.A., F.R.S., Secretar
the Meteorological Council.

[Received February 18th—Read March 19th, 1879.]

THE observations discussed in this paper were made by Mr. J. C. Willia
British Consul at Samoa, at the Consulate at Apia, in lat. 13° 50′ S
long. 171° 44′ W, on the north side of the Island of Upolu. The su
vertical at Apia on the 11th of February and the 30th of October.

The instruments were supplied by the Meteorological Office in 1861.

The lack of continuity in the register in the period under discussion,
the number of days given in the various tables, will show that the se
suffers much from want of regularity; but the observations have
handled with the object of rendering the means as complete as possible;
instance, as regards the barometer or thermometer, the mean has been c
puted for the hour at which most observations were recorded, and for
other hour at which fewer observations were given the differences betw
the individual observations have been taken, and the mean difference ap
to the mean obtained from the larger number of observations; this ren
the means comparable for the different hours, and secures the best
tainable monthly mean. It was, however, not thought desirable to fo
this method in the wind observations. With the resultant winds for
various hours the number of observations is always similar, the observat
at one hour never being taken unless a corresponding observation
obtainable for the other hours. In obtaining the mean force irrespectiv
the direction, all available forces have been used. The monthly means
not always been deduced from the same hours, but this will be evident
the various tables, where all the available data are shown.

The entire discussion has been conducted by Mr. Charles Harding, F.M
the cost being defrayed by the Meteorological Council.

BAROMETER.—The instrument was a Kew marine barometer; all
readings have been corrected for scale error, and reduced to 32° Fah. at
sea level. The pressure is generally steady, and the diurnal range is r
larly shown in the individual observations, with the exception of about

day in each month. The amplitude of the diurnal range is greatest from May to October, the average for this period in 1864 being ·071 in.; during the other half of the year the average is only ·052 in.; it must, however, be borne in mind that the exact amplitude cannot be obtained from such a limited series of observations, the differences between 8 or 9 a.m. and 4 p.m. being only available. The season in which the amplitude of diurnal range is greatest is also that of highest pressure. The maximum average amplitude of diurnal range is ·080 in. in August; the average pressure for this month is 29·953 ins., which is also the maximum pressure in any month. The minimum amplitude of diurnal range in January and December and the mean pressure similarly agree.

TEMPERATURE.—The thermometers were verified at Kew, and the necessary corrections have been taken into account. A screen was supplied with the thermometers, and was probably used. The individual observations seem to show that the thermometer was not unduly influenced by exposure to the sun; it must, however, be mentioned that the agreement between the air temperature and the temperature by the thermometer attached to the barometer is much closer than might be expected; this may perhaps be due to the barometer being exposed to the influence of the external air; the air temperature readings themselves seem satisfactory. The temperature varies but slightly with the season. In 1864 the lowest monthly average was 75°·3 in July, whereas the highest monthly average was 80°·0 in December, giving only 4°·7 as the range between the monthly means. There is much more cloud in summer than in winter, which must greatly shield the earth from the full power of the sun in the former period; this is evident in the greater range of temperature in winter, both in the mean results and in the absolute readings. The lowest absolute temperature recorded was 59° in August; the temperature of 84° was, however, reached in this month, and the absolute maximum recorded was only 88° in April, the range of temperature during the year being 29°. In every month there are instances of a rise of 10° in the temperature between 6 and 9 a.m.; the amount of change is greatest from July to October: on one occasion, in August, a rise of 21° took place in the three hours.

WIND.—The spot at which the observations were made is badly situated for wind observations, owing to the high land in the immediate vicinity. Northerly winds blow directly from the sea, and are probably little influenced by the land, but winds from the south of ESE must be materially affected. The influence of the sun on the direction of the wind at different times of the day is very evident. In 1864 the average direction at 6 a.m. was S 75° E, and at 9 a.m. it was N 85° E, showing a difference of 20°; the direction at 4 p.m. was similar to that at 9 a.m. A like influence is shown in the force of the wind (given by Beaufort's notation), which was twice as great at 9 a.m. as at 6 a.m.; the highest average force was attained in September. The prevailing wind is decidedly from the E, 40 per cent. of all winds in 1864 blowing from that direction. The results in Table III. have been corrected for 9° E variation; but no correction has been applied

TABLE I.—BAROMETER.

Date.	No. of Days.	Mean Results.								Absolute Read	
		Mean.	6 a.m.		8 a.m.		4 p.m.		Mean Daily Range.	Max.	Min.
			Mean.	Diff. on Daily Mean.	Mean.	Diff. on Daily Mean.	Mean.	Diff. on Daily Mean.			
		In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
1862.											
September	30	29·938	..	..	29·972	+·034	29·904	—·034	·068	30·07	29·80
October ..	31	29·913	..	..	29·945	+·032	29·880	—·033	·065	30·06	29·78
November	28	29·849	..	..	29·882	+·033	29·816	—·033	·066	29·95	29·76
December	30	29·830	..	..	29·855	+·025	29·805	—·025	·050	29·97	29·69
1863.					8 to 9	a.m.					
January ..	31	29·743	..	..	29·768	+·025	29·717	—·026	·051	29·98	‡29·41
February	28	29·886	..	..	29·912	+·026	29·860	—·026	·052	30·01	29·74
March ..	31	29·847	..	..	29·878	+·031	29·815	—·032	·063	29·93	29·72
1864.					9	a.m.					
January	11	29·838	..	..	29·859	+·021	29·816	—·022	·043	29·92	29·78
February	26	29·829	29·837	+·008	29·850	+·021	29·800	—·029	·050	29·90	29·66
March ..	31	29·842	29·839	—·003	29·867	+·025	29·820	—·022	·047	30·00	29·56
April	30	29·880	29·884	+·004	29·908	+·028	29·848	—·032	·060	29·99	29·75
May	31	29·920	29·913	—·007	29·963	+·043	29·885	—·035	·078	30·05	29·71
June	30	29·951	29·950	—·001	29·984	+·033	29·918	—·033	·066	30·08	29·83
July	24	29·923	29·931	+·008	29·954	+·031	29·883	—·040	·071	30·04	29·80
August ..	30	29·953	29·953	·000	29·993	+·040	29·913	—·040	·080	30·07	29·88
September	28	29·948	29·945	—·003	29·982	+·034	29·918	—·030	·064	30·06	29·82
October ..	19	29·950	29·961	+·011	29·979	+·029	?29·910	—·040	?·069	30·09	29·85
November	8	? 29·889	29·890	?+·001	29·923	?+·034	?29·855	?—·034	?·068	29·97	29·83
December	31	29·828	29·834	+·006	29·847	+·019	29·804	—·024	·043	29·93	29·65
Year 1864	..	29·896	*29·897	+·001	29·926	+·030	29·864	—·032	·062	30·09	29·56
1865.											
January	30	†29·770	..	..	29·770	..	..	..	..	29·94	‡29·06

* Corrected for January mean, which is missing.
† The mean is obtained wholly from 9 a.m. observations, which is a maximum hour.
‡ Reading recorded during a gale. See Wind remarks.

to the directions in Table IV., which are magnetic. The entry "calm" has not been systematically carried out, and probably should be much more frequent than might be inferred from Table IV. So far as the observations extend, they show the force of a gale to have been reached only on three occasions. In one case (6th September, 1862) the ordinary E wind was blowing with an increased force; but in the other two instances the winds were evidently of a cyclonic nature, forming the northern part of hurricanes travelling to the eastward; for both of these Consul Williams forwarded additional observations from his own station as well as extracts* from the logs of various ships; the observations contained in the latter are very rough, but they throw additional light upon the gales experienced at Apia.

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* The barometer observations quoted from these extracts are invariably uncorrected, nothing being known with regard to the errors of the instruments used.

TABLE II.—AIR TEMPERATURE.

Date.	Mean Results.									Absolute Readings.						
	No. of Days.	Mean.	6 a.m.		8 or 9 a.m.		4 p.m.		Mean Daily Range.	6 a.m.		8 or 9 a.m.		4 p.m.		Monthly Range.
			Mean.	Diff. on Daily Mean.	Mean.	Diff. on Daily Mean.	Mean.	Diff. on Daily Mean.		Max.	Min.	Max.	Min.	Max.	Min.	
1862.		°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
September	23	..	..	..	..	..	82·3	..	..	..	..	..	..	85	76	9
October	29	..	..	..	..	..	82·2	..	..	..	..	..	..	85	75	9
November	26	..	..	..	..	..	80·1	..	..	..	..	..	..	85	75	10
December	29	..	..	..	..	..	80·1	..	..	..	..	..	..	85	75	10
1863.					8 to	9 a.m.						8 to	9 a.m.			
January	31	..	..	..	79·5	..	81·9	..	..	..	..	82	76	87	77	11
February	28	..	..	..	79·6	..	..	..	..	..	..	85	74	..	..	11
March	31	..	..	..	78·9	..	..	..	..		..	84	70	..	..	14
1864.					9	a.m.						9	a.m.			
January	11	78·5 (?)	(74·3)*	—4·2 (?)	79·7	+1·2 (?)	(81·5)	+3·0 (?)	7·2 (?)	..	..	85	73		..	12
February	29	77·3	73·4	—3·9	79·0	+1·7	79·6	+2·3	6·2	79	71	85	73	84	75	14
March	31	78·3	74·6	—3·7	79·9	+1·6	80·5	+2·2	5·9	81	70	86	72	85	74	16
April	30	78·7	72·3	—6·4	81·9	+3·2	81·9	+3·2	9·6	76	69	86	76	88	74	17
May	31	77·8	71·3	—6·5	80·3	+2·5	81·8	+4·0	10·5	82	65	83	75	85	78	20
June	30	77·0	71·0	—6·0	79·6	+2·6	80·5	+3·5	9·5	78	65	82	74	83	78	18
July	24	75·3	68·0	—7·3	78·4	+3·1	79·5	+4·2	11·5	74	61	82	75	82	77	21
August	30	77·5	70·7	—6·8	80·4	+2·9	81·3	+3·8	10·6	77	59	84	74	84	78	25
September	28	78·8	72·0	—6·8	82·0	+3·2	82·5 (?)	+3·7	10·5	78	66	86	75	83†	81†	20
October	19	78·5 (?)	71·8	—6·7 (?)	81·6	+3·1 (?)	(82·0)	+3·5 (?)	10·2 (?)	79	61	86	76	84‡	(?) ‡	25
November	8	79·6 (?)	75·4 (?	—4·2 (?)	81·4 (?)	+1·8 (?)	(82·0)	+2·4	6·6 (?)	78	74	84	78	..	..	10(?)
December	31	80·0	75·2	—4·8	81·4 (?)	+1·4	83·5	+3·5	8·3	81	71	85	77	86	78	15
Year 1864	..	78·1	72·5	—5·6	80·5	+2·4	81·4	+3·3	8·9	82	59	86	72	88	74	29
1865.																
January	30	..	..	..	81·1	..	..	..	..	..	..	86	74	..	..	12

* The numbers between brackets are interpolated. † Only 4 observations. ‡ Only 2 observations.

TABLE III.—WIND.

Date.	Resultant Wind.										Mean Force, irrespective of Directio		
	From all Observations.			No. of Obs. at each hour.	6 a.m.		8 a.m.		4 p.m.				
	No. of Obs.	Direction.	Mean Force.		Direction.	Mean Force.	Direction.	Mean Force.	Direction.	Mean Force.	6 a m.	8 a.m.	4 p.m
1862.													
September	51	S 83° E	3·6	22	..	..	S 83° E	3·6	S 82° E	4·1	..	3·8	4·3
October ..	60	S 73 E	2·9	29	..	..	S 70 E	2·5	S 73 E	3·4	..	2·6	3·5
November	51	N 85 E	2·1	22	..	..	E	1·8	N 85 E	2·5	..	2·2	2·9
December	54	N 79 E	1·8	23	..	..	N 85 E	1·8	N 79 E	2·0	..	2·2	2·8
1863.							8 to 9	a.m.				8 to 9 a.m.	
January	62	N 16 W	1·3	31	..	..	N	1·1	N 29 W	1·5	..	2·3	3·2
February	41	S 87 E	2·0	16	..	..	S 86 E	0·8	S 89 E	2·3	..	1·9	2·8
March ..	44	N 78 E	0·9	18	..	..	N 68 E	0·6	N 77 E	1·1	..	2·2	2·3
1864.							9	a.m.				9 a.m.	
January	10	S 85 E	2·0	10	..	..	S 85 E	2·0	..	..	..	2·7	..
February	57	N 82 E	0·9	8	S 68 E	0·8	N 61 E	2·1	N 76 E	1·2	1·3	2·6	1·9
March ..	80	N 47 E	1·1	18	N 75 E	0·8	N 40 E	1·9	N 21 E	1·5	1·7	2·4	2·2
April	72	S 79 E	1·0	15	S 42 E	0·7	E	1·5	S 76 E	1·1	1·3	2·4	2·2
May	56	S 77 E	1·6	9	S 72 E	0·9	S 89 E	1·9	S 89 E	2·1	1·3	2·2	2·2
June	57	S 64 E	2·0	8	S 33 E	1·0	S 74 E	2·0	S 64 E	2·4	1·4	3·1	3·0
July	36	S 81 E	1·6	8	S 73 E	0·7	obs.	scant	S 84 E	2·5	1·0	2·7	3·2
August ..	48	S 87 E	2·6	15	S 73 E	1·4	N 89 E	3·8	obs.	scant	1·5	3·8	4·0
September	45	N 83 E	3·3	18	S 89 E	2·0	N 82 E	4·9	..	..	2·3	4·4	..
October ..	26	N 84 E	3·1	8	N 87 E	2·0	N 79 E	3·9	..	..	2·1	3·9	..
November	15	N 83 E	1·8	5	S 59 E	1·2	S 79 E	3·1	..	..	1·2	3·3	..
December	51	S 88 E	1·8	13	S 75 E	1·2	S 85 E	2·2	obs.	scant	1·5	2·7	3·5
Year 1864	..	S 89 E	1·9	..	S 75 E	1·1	N 85 E	2·6	..	..	1·5	3·0	2·
1865.													
January	28	N 71 E	1·7	28	..	..	N 71 E	1·7	..	..	..	3·2	..

Gale at Apia in January, 1863.—8 a.m., 11th, wind NW, force 8, barometer 29·59 ins.; noon, 11th, strongest wind NW 10, barometer 29·55 ins.; 4 p.m., 12th, lowest barometer, 29·41 ins., wind WNW 9, immediately after which the gale subsided. Much rain fell. The movement of the barometer throughout was very gradual, the greatest fall being at the rate of ·03 in. per hour. Centre of storm passed to south of station.

The French schooner 'Aritana' was in lat. 21° 50′ S and long. 173° 34′ W on the 5th, barometer 29·60 ins.; from this date she had the wind north-easterly, with a steadily falling barometer; the wind reached the force of a gale on the 10th, blowing from ENE at noon on the 12th. She experienced her lowest barometer, 28·70 ins., in the afternoon of this days in about lat. 18° 40′ S and long. 172° 40′ W; the wind backed through E, SE, S, to SW by 3 a.m. on the 13th. Centre of storm passed to north of ship.

TABLE IV.—WIND.

Date.	Percentage of frequency with the Mean Force, using all Observations at the Various Hours.																																	Observations.			
	N.		NNE.		NE.		ENE.		E.		ESE.		SE.		SSE.		S.		SSW.		SW.		WSW.		W.		WNW.		NW.		NNW.		Calm.	Total Number.	Distribution.		
																																			6 a.m.	8 or 9 a.m.	4 p.m.
1862.	o/o	M. F.	o/o	M. F.	o/o	M. F.	o/o	M. F.	o/o	M. F.	o/o	M. F.	o/o	M. F.	o/o	M. F.	o/o	M. F.	o/o	M. F.	o/o	M. F.	o/o	M. F.	o/	M. F.	o/o	M. F.	o/o	M. F.	o/o	M. F.	o/o		o/o	o/o	o/o
September	..	..		..	14	4·3	12	4·3	37	4·1	25	4·5	6	3·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	2·0	..	..	2	51	..	55	45
October ..	..	..	..	..		..	5	3·3	58	2·9	27	3·4	10	2·5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	60	..	50	50
November	8	1·3	..	..	19	3·2	10	2·6	45	2·6	2	1·0	8	3·5	..	..	..	..	..	..	2	1·0		..	..	..	..	..	4	1·0	2	2·0	..	51	..	51	49
December	7	3·3	..	..	11	2·0	9	2·2	54	2·4	9	2·6	..	..	..	..	..	.	..	..	.	..	..	..	..	..	..	..	8	3·3	2	3·0	..	54	..	52	48
1863.																																					
January	16	2·5	..	..	13	2·3	5	2·3	18	1·9	..	..	2	1·0	..	..	2	4·0	..	..	2	3·0	..	..	14	3·8	..	..	16	5·5	..	..	12	62	..	50	50
February	2	1·0	..	..	8	2·0	2	1·0	78	2·5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	4·0	..	..	8	41	..	59	41
March ..	16	1·4	..	..	2	3·0	..	..	53	2·4	2	3·0	..	..	..	..	2	1·0	.	..	2	3·0		..	14	2·3	..	..	9	2·3	..	..	..	44	..	52	48
1864.																																					
January	..	..	..	..	..	..	20	2·0	50	3·4	..	..	10	2·0	..	..	10	1·0	..	..	..	..	..	..	..	..	..	..	10	3·0	..	..	Not noted.	10	..	100	..
February	18	1·5	..	..	10	2·3	..	..	32	2·1	7	2·0	10	1·5	..	..	10	1·3	..	..	..	..	..	..	4	2·5	..	..	9	2·0	..	..		57	42	32	26
March ..	22	2·2	1	2·0	17	2·6	..	..	21	2·5	3	1·5	10	1·0	..	.	6	1·0	..	..	3	2·0	..	..	3	1·0	..	..	14	2·3	..	..		80	39	35	26
April	4	1·0	..	..	6	1·8	1	3·0	40	2·5	3	2·5	11	1·1	..	..	14	1·1	..	..	4	1·0	..	..	7	1·6	..	..	10	2·0	..	..		72	37	35	28
May	14	1·0	..	..	5	1·0	4	1·5	50	2·5	..	..	16	1·8	..	..	11	1·0	..	..	..	..	..	..	..	..	..	..		..	..	..		56	38	37	25
June	5	1·0	..	..	2	2·0	3	1·5	39	2·9	14	2·5	23	2·5	..	..	14	1·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..		57	42	35	23
July	3	2·0	..	..	8	1·0	..	..	50	2·8	11	1·5	14	1·4	..	..	..	..	..	..	3	1·0	..	..	..	..	..	..	11	1·3	..	..		36	44	28	28
August ..	..	..	..	..	9	3·8	17	3·1	54	3·4	2	1·0	8	1·0	.	..	6	2·0	..	..	2	1·0	..	..	..	..	..	..	2	3·0	..	...		48	35	50	15
September	..	..	..	..	9	3·0	45	4·5	29	3·5	2	1·0	11	1·4	..	..	..	..	...	..	..	..	..	..	..	..	..	..	2	2·0	2	2·0		45	40	58	2
October	..	..	..	..	4	4·0	50	4·2	31	2·9	4	1·0	4	1·0	..	..	7	1·0	..	..	..	..	..	..	..	..	..	..	.	..	..	..		26	38	58	4
November	13	4·5	..	..	..	..	14	3·5	33	2·2	33	1·8	7	1·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		15	47	47	6
December	..	..	..	..	12	2·8	6	2·0	53	2·8	8	1·8	6	1·0	..	..	3	1·0	..	..	..	..	..	..	6	2·3	..	..	6	1·7	..	..		51	39	39	22
Year 1864	7	1·9	0	2·0	7	2·4	13	2·8	40	2·8	7	1·7	11	1·4	.	..	7	1·2	..	..	1	1·3	..	..	2	1·9	..	..	5	2·2	0	2·0	..	..	37	46	17
1865.																																					
January	11	2·0	4	7·0	14	2·0	7	3·5	39	3·9	..	..	..	..	..	..	..	..	..	..	4	3·0	..	..	10	3·0	..	..	11	2·0	..	..	..	28	..	100	..

TABLE V.—WEATHER.

Percentage of Weather Notations.									
Date.	No. of Obs.	4 p.m.			Date.	No. of Obs.	9 a.m.		
		b.	o.	r.			b.	o.	r.
1862.		o/o	o/o	o/o	1864.		o/o	o/o	o/o
September..	22	59	41	23	January....	11	27	73	27
October	30	73	27	13	February ..	21	52	48	
November ..	28	43	57	25	March	27	52	48	
December ..	29	41	59	34	April	29	79	21	Incomplete.
					May	26	62	38	
1863.		8 to	9 a.m.		June	22	77	23	
January ..	28	43	57	29	July	13	69	31	
February ..	26	65	35	?	August	24	79	21	
March	31	81	19	?	September	24	79	21	
					October	16	81	19	
1865.		9	a.m.		November ..	8	50	50	
January	30	37	63	47	December ..	25	60	40	
					Year 1864 ..	..	64	36	?

The Hamburg brig 'Grassbrook' was in about lat. 29° 50′ S and long. 166° W on the afternoon of the 12th, when the gale commenced from ENE, and at a.m. 13th (?) the storm-centre seems to have passed over the ship in about lat. 30° S and long. 166° 30′ W, as the wind changed from N by W to S by E; the vessel did not lose the gale till the 15th. On the 14th the Captain remarks: "In the proximity of a hurricane the last few days, steering to the south the gale increases and the barometer falls, steering to the north the contrary." (It is supposed that the ship was keeping nautical time.)

The Sydney schooner 'Martha,' anchored at Kiva Fiji, (lat. 16° 50′ S and long. 179° E), on the 8th, records barometer 29·60 ins., and falling, wind E, and heavy rain; 9th, barometer 29·40 ins., wind ESE, violent squalls and rain; 10th, barometer 29·35 ins., strong gale SE to SSE; 11th, barometer 29·50 ins., moderate S to SW wind. Centre of storm passed to north of ship.

Gale at Apia in January, 1865.—Noon, 28th, gale commenced from ENE, barometer 29·49 ins.; it gradually fell to 29·06 ins. at 9 p.m., wind N 10, after which the barometer began to rise, and the wind shifted to NW; gale ended at W at 7 a.m. on the 29th, the barometer being 29·32 ins. The maximum rate at which the barometer fell was ·07 in. per hour, the rise was less rapid. Centre of storm passed to south of station.

The Hamburg schooner 'Ida' reports gale from ENE on 25th, at 5 p.m., barometer 29·72 ins.; noon 27th, in lat. 12° 42′ S and long. 172° 51′ W, increasing gale from NE, barometer 29·24 ins., rain and increasing sea from NW; 8·30 p.m. wind veering round to S, barometer 29·18 ins. 8 p.m. SW increasing gale, barometer 29·39 ins.; 28th, 2 a.m., hurricnae-like gale; 8 a.m. decreasing gale; ship still records decreasing gale from WNW at noon 29th, in lat. 12° 26′ S and long. 172° 37′ W.

The schooner 'Mary,' in about lat. 14° 15′ S and long. 172° 5′ W, had he lowest barometer, 29·25 ins., at about 10 p.m. on the 28th, wind S by E. Centre of storm passed to north of ship.

The brig 'Lalla Rookh,' in lat. 20° 50′ S and long. 159° 50′ W, on the 27th, had a heavy easterly sea; in lat. 19° 54′ S and long. 159° 13′ W on the 28th a heavy confused sea, wind E, barometer 29·90 ins.; 30th and 31st very heavy long westerly sea; February 1st, in lat. 22° 9′ S and long. 158° 48′ W, heavy gale from E, with very heavy sea, heavy thunder and lightning to N, barometer 29·75 ins.; 2nd, in lat. 22° 8′ S and long. 159° 12′ W, blowing a hurricane with very heavy gusts, ship hove-to, sea running from all quarters, constant rain for 24 hours, wind backed from E to SSE, and the barometer fell from 29·75 ins. to 29·40 ins. at noon, 2nd; evening, blowing very heavy; midnight, moderated; 3rd, daylight, set all sails, barometer rose from 29·40 ins. at noon 2nd to 29·90 ins. noon 3rd, wind S. Centre of storm passed to north of ship.

Using the data from Apia and the 'Lalla Rookh,' it seems that this hurricane was travelling in a direction SE by E at the rate of about 7·8 miles per hour, and was traced for 900 miles.

Weather.—The entry of the weather has been very imperfectly made, little more being done than to distinguish between a blue sky and an overcast sky; it is only in a very few months that even the occurrence of rain is noted.

The registers kept on board ship for the Meteorological Office yield little information for the Samoan Group; but the data are of a very high quality, and are of sufficient importance to be embodied in this Paper. There are four records, three kept in May, and the remaining one in November; those for May will be dealt with first.

Winds were generally light from between NE and SE, with a good deal of calm; the log notes on the 30th of May, at 8 p.m., "a heavy squall from the eastward, with most vivid lightning, thunder, and rain; no perceptible movement in the barometer during its continuance, which stood at 30·02 ins."

The weather throughout was unsettled; several entries of lightning and thunder occurring on six days out of the seven; rain and mist were also prevalent.

Observations made by Captain A. D. Wood on board the Ship 'Oracle,' sailing very slowly between lat. 11° and 20° S, and long. 177° and 170° W—1866, May 7th to 17th. No. of days 11.

Mean Barometer 29·89 ins., readings ranging from 29·98 ins. to 29·78 ins.
„ Air Temp. 77°·6, „ 85° „ 72°

The wind was chiefly between ENE and SE, force light to moderate, but it blew a gale from the southward on the morning of the 13th, and at noon 16th. The weather during the period was very unsettled, heavy rain being frequent, and a severe thunderstorm occurred on the 11th.

The wind was chiefly from between E and NE, force light, frequently

TABLE VI.

Observations made by E. P. Bedwell, Master, on board H.M.S. 'Hecate,' Captain (now Vice-Admiral) Sir G. H. Richards, C.B., in Apia Harbour—1863, May 25th to 31st, inclusive.

Hour.		2 a.m.	4 a.m.	6 a.m.	8 a.m.	10 a.m.	Noon.	2 p.m.	4 p.m.	6 p.m.	8 p.m.	10 p.m.	Midnt.	Daily Mean.
Barometer.	Mean ..	In. 29·973	In. 29·956	In. 29·962	In. 30·011	In. 30·024	In. 29·978	In. 29·945	In. 29·932	In. 29·962	In. 29·994	In. 30·013	In. 30·001	In. 29·979
	Diff. from Daily Mean	—·006	—·023	—·017	+·032	+·045	—·001	—·034	—·047	—·017	+·015	+·034	+·022	..
Air Temp.	Mean ..	75°·6	75°·2	74°·0	76°·6	79°·1	81°·8	81°·8	82°·4	78°·8	76°·8	75°·9	75°·0	77°·8
	Diff. from Daily Mean	—2·2	—2·6	—3·8	—1·2	+1·3	+4·0	+4·0	+4·6	+1·0	—1·0	—1·9	—2·8	..
Vapour Tension.	Mean ..	In. ·833	In. ·826	In. ·807	In. ·823	In. ·847	In. ·863	In. ·872	In. ·860	In. ·843	In. ·829	In. ·827	In. ·806	In. ·836
	Diff. from Daily Mean	—·003	—·010	—·029	—·013	+·021	+·027	+·036	+·024	+·007	—·007	—·009	—·030	..
Sea Surface Temp.	Mean ..	..	..	..	82°·1	..	82°·4	..	..	..	81°·9	..	..	..

TABLE VII.

Observations made by Staff-Commander Henry Hosken on board H.M.S. 'I
Captain A. H. Hoskins, in Apia Harbour 1876—May 23rd to 31st, inclusive

Hour.		4 a.m.	8 a.m.	Noon.	4 p.m.	8 p.m.	Midnt.	D Me
Air Temp.	Mean	75°·6	76°·5	80°·8	81°·6	79°·0	77°·0	7
	Diff. from Daily Mean	—2·8	—1·9	+2·4	+3·2	+0·6	—1·4	.
Vapour Tension.		In.	In.	In.	In.	In.	In.	I
	Mean	·737	·774	·811	·792	·789	·757	·7
	Diff. from Daily Mean	—·040	—·003	+·034	+·015	+·012	—·022	.
Sea Surface Temp.	Mean	80°·5	80°·3	82°·3	83°·0	81°·4	80°·5	8
	Diff. from Daily Mean	—0·8	—1·0	+1·0	+1·7	+0·1	—0·8	.

TABLE VIII.

Observations made by Staff-Commander Henry Hosken on board H.M S. 'Pearl,' Commodore James G. Goodenough, in Apia Harbour 873, November 8th to 12th, inclusive.

	Hour.	2 a.m.	4 a.m.	6 a.m.	8 a.m.	10 a.m.	Noon.	2 p.m.	4 p.m.	6 p.m.	8 p.m.	10 p.m.	Midnt.	Daily Mean.
Barometer.	Mean ..	In. 29·896	In. 29·867	In. 29·874	In. 29·913	In. 29·916	In. 29·893	In. 29·871	In. 29·846	In. 29·890	In. 29·903	In. 29·917	In. 29·897	In. 29·890
	Diff. from Daily Mean	+·006	—·023	—·016	+·023	+·026	+·003	—·019	—·044	·000	+·013	+·027	+·007	..
Air Temp.	Mean ..	..	..	..	77°·9	..	81°·0	..	80°·3	..	..	..	..	78°·5*
Vapour Tension.	Mean ..	..	..	..	In. ·785	..	In. ·789	..	In. ·770	..	..	..	..	..
Sea Temp.	Mean ..	..	..	..	..	..	81°·0	..	..	..	..	..	..	..

* Approximate.

The weather was generally fine, and the sky for the most part clear, lling at night.

wind observations show a good deal of calm and light variable airs, from the east. The weather was showery and unsettled on two days, ne on the remaining three days. During this period the 'Pearl' ed 84° as the maximum air temperature, and 78° as the minimum.

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following notes have been gathered from a paper on the Weather moa, by Dr. E. Gräffe, published in the 'Journal des Museum Froy,' 1873, Heft II. (Friederichsen & Co., Hamburg):—

perature.—The temperature is not subject to great variations owing to sular situation. In winter frequent strong and cool SE winds lower the temperature to between 64° and 70°; these winds are, however, not prevalent, so that the temperature soon recovers itself, and the mean of the winter months reaches 77°·9. In the summer months, December to April, warm NW winds raise the temperature to a maximum of 92°·8, and the whole summer period has a mean temperature of 82°·6. The mean yearly temperature of the Navigator Islands is therefore 80°·2; this is comparable with the Canary Islands, which are more distant from the Equator. Besides a maximum difference of temperature in the seasons of 28°, there is a periodical daily variation of 9°—11°, and on some days the range amounts to 18°. The lowest temperature occurs about 5 a.m., and the highest from 2 to 3 p.m. It should be remarked that the observations on board ships in the harbour of Apia show an average range of temperature of only 2°—4°. The mean between the observations on board ships and on land, viz. 5°—7°, may be taken to indicate most accurately the variation of the daily temperature. Observations of the sea surface give a mean yearly temperature of 83°·8, that is, 3°·6 higher than the mean air temperature. There is little variation in the sea temperature during the year; from July to September it is between 79°·3 and 81°·5, while from December to April it reaches 82°·5 to 86°.

Winds.—These are generally "Trades" or easterly winds. The summer, November to April, is distinguished by variable light E winds, often interrupted by calms; at this period westerly winds are also experienced, sometimes with rain squalls, and sometimes in heavy storms, always accompanied with rain. Hurricanes occur especially from January to March, or the middle of April; they commence with a violent NE wind, which passes through N and W to SW. These hurricanes are caused by the conflict of the NW winds with the Trade winds, and their beginning and ending are accompanied by frequent electrical phenomena. From the middle or end of April to November fresh Trade winds occur, especially in the first half, rarely interrupted by calms and SW winds. The months July, August, and up to the middle of September are distinguished by cool SE winds, which frequently blow in violent squalls. In the last half of the winter the Trade is not so sharp, and is often interrupted by calms and light W winds. The behaviour of the Trade wind on the land is worthy of remark. While at a distance from the island, it constantly blows with equal strength, and only gets lighter during the night, it acts quite differently near the land. Here, from daybreak to 8—9, and even 10 a.m., there is a calm; at this time the breeze begins to be felt, slightly ruffling the sea, up to about 2 p.m., when it reaches its greatest strength; from 2—3 p.m. it gradually decreases, and at sunset ceases entirely; then a light breath from the land commences, which becomes stronger at about 1—2 a.m., and ceases again at about 6 a.m. The land breeze is felt 2—4 miles from the land. This is the general picture of the winds during the Trade season on the coasts; but it is often disturbed by stronger currents, which mask the picture both by day and night, and stiff E, SE, and SSE winds blow for some time, and the land wind is not felt at night while these strong winds blow.

Rain.—The rainy season is from December to April, but it is often interrupted by fine clear weather. At this period the climate is very damp, and the roads are covered with stagnant water. Rain is not limited to the summer, but occurs during winter. An amount of 106 ins. has been measured in one year. Hail never falls in Samoa, but hailstorms have been observed, although very rarely, at Tonga, further south. Dew is abundant during summer.

The remarks by Dr. Gräffe on Atmospheric Pressure have not been quoted, as they differ so very widely from the statements of all other observers in Samoa. It must be noticed that Dr. Gräffe evidently had access to the temperature observations made by Consul Williams, since he quotes the extreme temperatures observed at the English Consulate for each month of the year 1864.

The paper by Dr. Gräffe also gives observations made on board ships at anchor in Apia Harbour; the barometer and temperature means have been calculated for the various hours, but the results do not warrant more than the monthly means being stated. The year in which the observations were made is not known, and only a few days are represented in each month.

TABLE IX.

Month.	No. of Days.	Monthly Means.		
		Barometer.	Air Temp.	Sea Temp. at Noon.
		In.	°	°
January	8	29·815	80·3	83·3
February	4	29·795	79·6	83·8
March	5	29·597	81·0	83·8
April	3	29·869	80·7	84·4
August	3	29·896	80·7	81·3
October	5	30·040	82·2	82·8
November	4	30·316	82·2	84·0
December	4	29·589	83·0	84·2

XII. *On the Results of Comparisons of Goldschmid's Aneroids.* By G. M. Whipple, B.Sc., F.R.A.S., Superintendent of the Kew Observatory.

[Received January 7th.—Read April 16th, 1879.]

A form of Aneroid, known after its inventor as the Goldschmid Aneroid, has been for some time in use on the Continent, but is not yet familiar to English observers.

In the summer of 1878, the Kew Observatory received a batch of these instruments from the makers, Messrs. Hottinger & Co., of Zürich, with a request that they might be compared with the Standard Barometers, and, if found satisfactory, introduced to the notice of the British public.

The instrument differs from the ordinary Aneroid in a most important particular; the vacuum chamber is not constrained to drive a train of wheelwork, but has merely to raise or lower an exceedingly light lever, which rests upon its upper surface. In order to take a reading, the observer turns a micrometer screw, which in some of the instruments is fixed upon the top of the case, and in others actually forms the top of the case itself. This micrometer screw does not in any way act upon the lever or rod actuated by the vacuum chamber, but moves another rod up and down which bears a mark upon its face. This mark being brought by the screw into contiguity with a corresponding mark upon the lever, the instrument is set, and its reading can then be determined by means of the graduated head to the micrometer screw.

There are several forms of the instrument, some adapted for use on land, others at sea, whilst those constructed for measuring the heights of mountains have the micrometer graduated with an altitude scale. As there is no mechanical arrangement for correcting the readings for variations of temperature, a scale of corrections is furnished with each instrument by the maker.

Seven Aneroids were compared for several weeks with the Standard Barometers of the Observatory, with the following results:—

Instrument.	Mean Error.	Mean Difference.	Greatest Error.
No.	In.	In.	In.
100	+0·05	±0·01	+0·07
108	—0·05	±0·01	—0·08
112	—0·02	±0·01	—0·04
	mm.	mm.	mm.
3154	—1·2 (—0·05)	±0·1 (·004)	—1·5 (0·060)
3155	+0·5 (+0·02)	±0·2 (·008)	+1·0 (0·040)
3156	+1·2 (+0·05)	±0·1 (·004)	+1·6 (0·063)
Pocket 1040	+2·7 (+0·11)	±0·5 (·020)	+3·5 (0·138)

Owing to the impossibility of setting these instruments in an exhausted receiver, the important advantage of being able experimentally to determine the instrumental errors at low pressure is lost, and all that could be done was to try the effect of exhaustion upon the Aneroids after they had been subjected to this process. The usual result in the case of ordinary Aneroids is a displacement of the scale of the instrument, which in some instances lasts for several weeks. Three of the Goldschmid Aneroids were subjected to a pressure of 26 ins., and after exhaustion were found to return exactly to their former indications; in this respect they compare most favourably with dial instruments. But from some unknown cause the three metrical Aneroids, Nos. 3154-56, did not fall to anything like the proper amount when pressure was reduced, and the pocket instrument, although divided to 400 mm. (15·75 ins.), did not descend below 600 mm. (23·62 ins.), proving therefore to be defective.

A neat form of the Goldschmid Aneroid, adapted to automatic registration, is also constructed. The lever resting on the vacuum chamber is made so as to project from the case, and carries a 'pricker at its extremity. This, being struck hourly by a hammer driven by clockwork, registers the position of the lever at the time on a band of paper continuously moved forward by the same clock at the rate of about 2 ins. per diem. A pricker rigidly attached to the instrument below the Aneroid pointer indents the paper simultaneously, and so gives a zero line from which the curve of varying pressure may be measured. The paper which receives the register is supplied to the instrument from a roller, as in a printing telegraph; thus the instrument will record continuously for weeks without further attention than the winding of the clock. The self-recording instrument exhibited to the meeting has been in action at Kew for several months.

From a series of 80 measurements of the traces obtained from it, and compared with eye observations of the Kew Standard Barometer (reduced to 32°) observed at corresponding times, the mean difference was 0·01 in.; and the mean difference irrespective of sign was equal to 0·015 in. The extremes varied from +·03 to —·04 in.

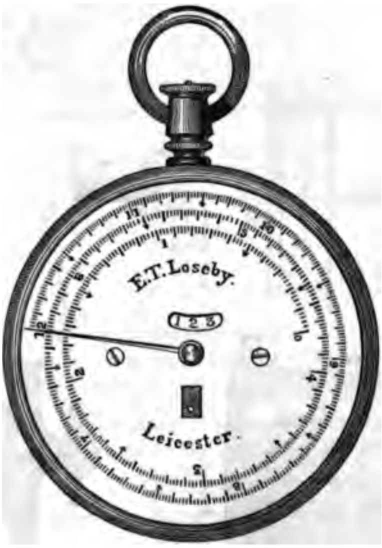
The annexed engravings (p. 192), representing different forms of the instruments, have been printed from blocks supplied by Messrs. Hottinger & Co.

DISCUSSION.

Mr. SYMONS observed that this was not the first instrument in which the wheel-work had been dispensed with, for Mr. Loseby, of Leicester, some years ago brought out an aneroid with a similar arrangement. He thought that this instrument was only a development of Weilenmann's aneroid, which was exhibited at the Loan Exhibition at South Kensington. He would like to know how the correction for temperature was got over in the self-recording instrument. It was a very serious objection to these aneroids if they could not be read at low pressures under the air-pump. He asked permission to lay before the meeting a description of the Maury barometer.

"This instrument, invented by Mr. E. T. Loseby, of Leicester, in 1860 and 1861, is named after the late eminent American geographer and meteorologist, Captain Maury, Director of the Washington Observatory.

"The engraving shows the actual size of the instrument, which is much like an ordinary aneroid barometer in appearance, and contains a vacuum box of similar, but somewhat improved, construction. This is larger, in proportion to the size of the instrument, than the vacuum box employed in the aneroid, and the spring by which it is distended is much longer, so that the instrument has a greater range. The rise and fall of the box is measured by a fine micrometer screw, which is turned by the observer, either through an aperture in the glass, or, as shown in the engraving, by a milled head in the pendant of the case. This micrometer screw is placed immediately over a steel stud, which is attached to the centre of the vacuum box, and projects



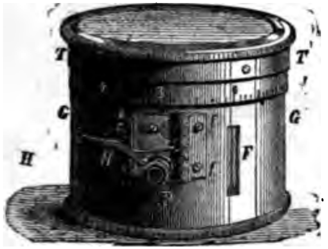


FIG. 1.

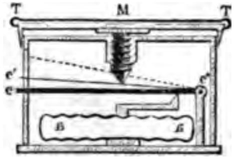


FIG. 2.

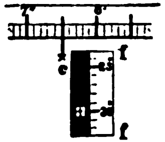


FIG. 3.

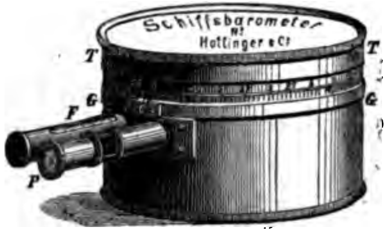


FIG. 4.

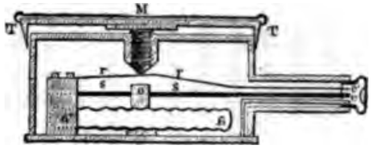


FIG. 5.

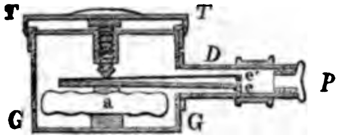


FIG. 9.

FIG. 6.

FIG. 7.

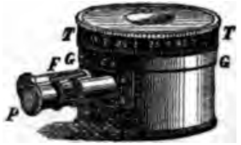
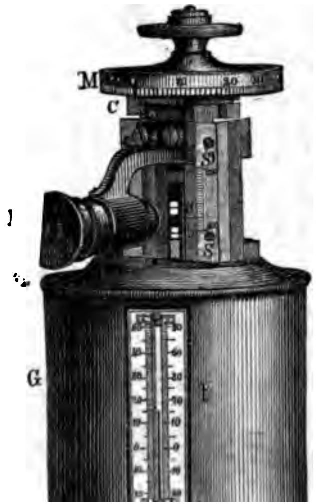
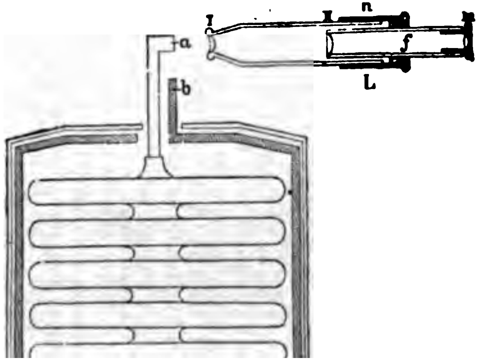
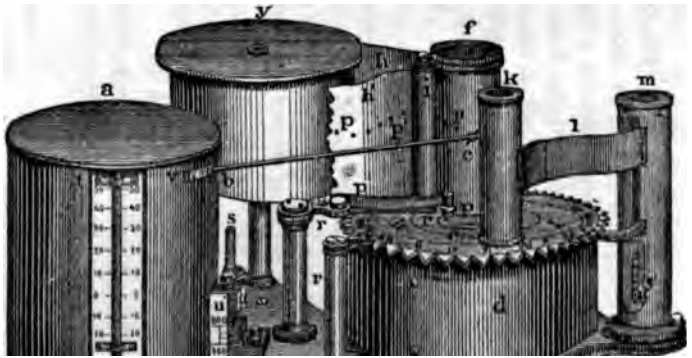


FIG. 8.







above it. Between this stud and the end of the micrometer screw a pivoted drop-piece is placed, which falls the instant the screw is unturned sufficiently to remove the bearing points of the screw, stud, and drop-piece out of contact with each other. The drop-piece is pivoted by a screw into a frame attached to the top of the vacuum box, and is made to fall either by its own gravity or by a suitable spring, and an aperture is left in the dial to enable its fall to be seen. The divisions on the dial are continued round in spirals. The hand, which is fixed to the micrometer screw, and turns round with it, extends across all the divisions; and a small index dial, visible through an aperture in the large one, indicates which spiral of fine divisions the hand is pointing to. All three figures on the small dial are shown at once, to avoid the difficulty which sometimes arises with a small opening of having only the unintelligible parts of two figures visible. The figure nearest the middle is the one that should be read. The essential principle, therefore, is the abolition of direct work by the vacuum box, and of the friction due to the ordinary levers and chain. It should be added that the scale was proposed to be either barometric inches or altitudes in feet. The engraving represents divisions for altitudes from 0 to 1,200 feet."

Captain TOYNBEE remarked that the weak point in aneroids was their liability to change, so that they gave different readings when the atmospheric pressure was the same. He would like to know from Mr. Whipple whether this very great defect was noticeable in Goldschmid's aneroids.

Mr. FIELD considered that the principle of the instrument, viz. giving the vacuum box as little work as possible to do, was undoubtedly right; but thought it a great objection to this Aneroid that it could not be tested under an air-pump.

Mr. STRACHAN said that ordinary Aneroids always needed different corrections for diminishing as compared with increasing pressures, and he did not see why this class of instrument should act differently to the rest. Four or five years ago he tested an Aneroid, which was somewhat similar in principle to one of those exhibited; and he found the corrections were so variable that it was quite useless. He did not know how the makers of these Aneroids calculated the scale for low pressures, as they could not be tested under the air-pump.

Mr. WHIPPLE, in reply, said that as to their reliability, the makers of these Aneroids stated that they improved them every year. With regard to the correction for temperature, he had not attempted to examine it; all he had done was to compare the instruments with the standard barometer, using the table of corrections provided by the maker and already fixed to the instruments.

EXPLANATION OF THE ENGRAVINGS.

Fig. 1 is the simplest form of the instrument, represented also in section in Fig. 2. *G G* is the case, *T* the divided head, *e e* the lever acted upon by the vacuum box *a a*. *e'* the spring, which is forced down at the time of setting by the screw M, until its index coincides with that of the lever *e e*. *f f* is the scale indicating the number of revolutions made by the micrometer head; this is also shown enlarged in Fig. 3. *P* is a reading glass supported by the arm *H*, and *F* is a thermometer.

The aneroid for marine use, shown in Figs. 4 and 5, has longer levers, r, than the preceding instrument, but the range is confined to one turn of the micrometer head T, which corresponds to a movement of the barometer of 5 inches. The reading off index *c* is fitted to the moveable ring *G*, so that the aneroid can at any time be readily adjusted to the true height of the mercurial column.

The appearance of the indices when *unset* is shown in Fig. 6, and when *set* in Fig. 7. The dimensions of the instrument are: diameter 3⅓ ins., height 2¼ ins.

Figs. 8 and 9 represent the Pocket Aneroid, a reduced form of Fig. 4, but capable of indicating differences of 0·01 in. of pressure at heights of from 10,000 to 15,000 feet. Its diameter is 1½ ins., and height 1¼ ins.

Prof. Weilemann's instrument is shown complete in Fig. 10 and in section in Fig. 11. An index *a*, attached to the uppermost of a series of five vacuum chambers, rises and falls through a distance equal to the sum of their separate expansions or contractions. *V* is a fixed mark on the case, and *I* the microscope containing a fiducial line, which, being moved by a micrometer screw (not represented in the fig.), can be used to measure the distance between the points *a* and *b*.

This distance, given in terms of revolution of the screw, on the scale *S S*, and in fractions of a revolution by the divided head M, being known for a standard barometric pressure, furnishes at any time a value, which, by means of suitable tables, provided with the instrument, can be readily converted into the equivalent barometer reading. *t* is a thermometer to give the temperature of the instrument at the time of observation. Its dimensions are: diameter 3⅛ ins., height 5¼ ins.

The self-registering aneroid, Fig. 12, is a combination of both Weilemann's and Goldschmid's methods. The case a encloses a pile of vacuum boxes, which carries a lever b c, furnished with pricker c. S is the screw for adjusting its position. d is the clock, carrying a roller f, which draws a paper band off the drum Y, the india rubber grippers i keeping it tightly stretched round the roller.

The hammer k is attached to the axis m by the arm l. The clock dial revolves once in 48 hours, and has its edge cut into ratchet-teeth. A pawl on the axis m takes into these, and so causes the hammer k to strike the pricker c hourly.

The instrument, which is usually covered with a glass case, is 7¾ ins. long, 7 ins. wide, and 4¼ ins. high.

PROCEEDINGS AT THE MEETINGS OF THE SOCIETY.

March 19th, 1879.

Ordinary Meeting.

Charles Greaves, M.Inst.C.E., F.G.S., President, in the Chair.

Richard Burniston, The Burtleys, Farnham;
William Horatio Crawford, Lakelands, Cork;
James Davies, Plasnewydd, Llanrhaiadr, Oswestry;
The Right Hon. Earl of Derby, LL.D., F.R.S., 23 St. James's Square, S.W.;
Henry Downs, Manor House, Basingstoke;
Samuel Egar, Wyrde, Thorney, Peterborough;
J. Stewart Hodgson, Lythe Hill, Haslemere;
Samuel Hollins, Sion House, near Stourbridge;
T. M. Hopkins, Lower Wick, Worcester;
Henry Horncastle, Whitemoor House, Ollerton;
Charles William Johnson, Gidea Hall, Romford;
Edward Montagu Nelson, Hunger Hill House, Ealing, W.; and
Frederick Wilkin, 35 Thornton Heath, Croydon,
were balloted for and duly elected Fellows of the Society.

The following Papers were read:—

"Dew, Mist and Fog." By George Dines, F.M.S. (p. 157.)

"On the Inclination of the Axes of Cyclones." By the Rev. William Clement Ley, M.A., F.M.S. (p. 167.) The discussion on this Paper was postponed to the May meeting.

"Contributions to the Meteorology of the Pacific. No. III. Samoan or Navigators Islands." By Robert H. Scott, M.A., F.R.S. (p. 178.)

The Meeting was then adjourned.

April 16th, 1879.

Ordinary Meeting.

Charles Greaves, M.Inst.C.E., F.G.S., President, in the Chair.

Richard William Abbots, Burton-on-Trent;
Rev. Stephen Allen, D.D., Shouldham Hall, Downham Market;
Edwin H. Banks, Highmoor, Wigton;

Frederick Joseph Bramwell, F.R.S., M.Inst.C.E., 37 Great George Street, S.W.;
James Alexander Caird, Northbrook, Micheldever;
Edward Henry Cardwell, Hillside, West Horsley;
The Right Hon. Earl of Durham, Lambton Castle, Fence Houses, Durham;
John Farquharson, 3 Rosetta Street, Lymington;
William Garnett, Bushall Lodge, Clitheroe;
Rev. Charles Wigan Harvey, M.A., Ewelme, Wallingford;
Wickham Inskip, Caldecote, Baldock;
The Right Hon. Earl of Powis, 45 Berkeley Square, W.; and
David Robie, Bedford,
were balloted for and duly elected Fellows of the Society.

The following Papers were read :—

"On the results of the Comparisons of Goldschmid's Aneroids." By George Mathews Whipple, B.Sc., F.R.A.S. (p. 189.)

"On the Temperature of the North Atlantic during the month of March 1877." By P. F. Reinsch.

During a voyage across the Atlantic in the month of March, 1877, I registered the temperature of the ocean and of the air several times a day. The results show the position of the Gulf Stream at that season, as distinguished from the water standing over the great banks of Newfoundland, and the relations of the temperature of the water and of the air. The following table contains a statement of the observations from March 15th to March 23rd, with the latitude and longitude of the localities :—

Date.		Water.	Air.	N Lat.	W Long.
March	13th	50°·0	47°·7	49° ′	18° ′
		51·1	45·5	49	24
	16th	50·5	45·0	49 50	27
		50·0	46·8	48 50	28
		50·0	47·7	48	30
	17th	51·1 (steady)	47·7 (variable)	48-47	31-38
	18th	53·2	46·6	47	40
		53·2	48·7	46	42
		54·5	47·7	46	43
		56·7	47·7	45	45
	19th	49·3	52·2	44 50	47
		45·5	49·5	44	49
		39·6	41·5	44	51
		38·7	45·5	43 50	52
	20th	35·2	36·5	43	54
		35·6	36·0	42	59
	21st	36·5	34·2	42	61
	22nd	50·0—36·5 (very variable)	52·2—41·0	41	66
	23rd	39·7	42·4	41	67 50
		38·7	41·0	41	70
		39·7	43·3	40 50	73

The temperature of the North Sea, as ascertained in several localities on the voyage between Bremen and Southampton, was on March 12th :—

Water - -	39°·7	39°·7	37°·8	41°·0
Air - -	30·9	32·0	30·9	32·0

In the Channel from the entrance to Southampton :—

Water - -	44°·2	43°·2	41°·0
Air - -	39·9	38·7	35·4

In the Channel at its mouth on March 14th :—

Water - -	50°·0	50°·7
Air - -	47·7	47·7

These last observations give nearly the same value for the temperature of the water of the North Sea, and the water of the American coast, 13° of latitude further south. The foregoing series show that the temperature of the surface of the Ocean from the European coast to W long. 30° is uniformly about 50°. The difference between the temperature of the water at the two entrances of the Channel from the North Sea, and from the Ocean, will also be noticed: from W long. 30° to 43° the temperature successively rising to 54°·7; under W long. 45° it reached the maximum, 56°·7. From this point it suddenly decreased between W long. 45° and 47° to 49°·3, and from W long. 45° and 52° it gradually fell to 38°·7. The minimum temperature, 35°·2, was observed under W long 54°. About 60 miles from the American coast opposite Sandy Hook, the temperature of the water rose to 39°·7, and the temperature of the air varied between 41° and 50°. Observations on sea phosphorescence, and on the distribution of floating masses of seaweed, showed some relations to the temperature of the Ocean, *i.e.* to the position of the Gulf Stream. The first traces of phosphorescence were noticed in N lat. 49°, W long. 28°, and the phosphorescence reached its highest intensity during the night of March 18th, between N lat. 46°, W long. 43°, and N lat. 45°, W long. 45°. The phenomenon disappeared under W long. 46°, and was observed again between W long. 60° and 65°.

Floating seaweed (composed of *Desmarestia* and *Sargassum*) appeared in N lat. 47°, W long. 35°. Advancing towards the great banks the masses of seaweed became rarer, and disappeared on approaching the continent.

Peculiar relations of the temperature of the Ocean are observed near the banks of Newfoundland. The water standing over the banks is distinguishable by its colour (whitish green by vertical light) from the deep blue green of the Atlantic Ocean, and was crossed by the steamer in a length of 200 miles. The temperature observed in four different localities was: 49°·3, 45°·5, 39°·6, 38°·7. The distance between the locality with the observed maximum temperature in N lat. 45° W long. 45°, and N lat. 45° W long. 47°, where the temperature suddenly decreased, was scarcely 100 miles. It is evident that the current from the south did not run over the shallows of the bank; more likely at this time (March 18) the water on the banks was distinctly limited, and that the Gulf Stream passed the eastern boundaries of the banks under W long. 45°. The lowest temperature of the sea water was observed west of the banks. The division of the Gulf Stream begins under Newfoundland, one stream running N to Baffin's Bay, the other one running NE between the British Isles and Iceland. Opposite Newfoundland, according to Dr. Neumayer, the breadth of the Gulf Stream is about 780 miles, and the widespread influence of that current is felt up to the mouth of the Channel.

The results of these observations are briefly the following:—

1. The temperature of the North Sea on the North German Coast compared with the water of the Channel was in the month of March 3°·6-5°·4 lower, and the temperature of the North Sea on the North German Coast was equal to that of the water off the North American Coast 13° of latitude farther south.
2. The temperature of the water within the Channel, compared with that of its mouth, was 5°·4-9°·0 lower.
3. The temperature of the water off the mouth of the Channel to 1,000 miles distance west, was in the month of March almost constantly 50°.
4. From N lat. 47° W long. 40° to N lat. 45° W long. 45° the temperature decreased rapidly towards the banks of Newfoundland, the temperature of the water over the banks being several degrees lower than that of the water of the adjacent Ocean to the east.
5. According to these observations it is evident that the Gulf Stream did not flow over the shallows of the banks. The western boundaries of the Gulf Stream under W long. 47° coincide with the eastern boundaries of the banks.
6. The maximum temperature of the water and of the air in the midst of the Ocean do not coincide.

DISCUSSION.

THE PRESIDENT (Mr. Greaves) remarked that meteorologists were greatly indebted to marine observers for a knowledge of the pressure of the air over the Ocean, and of the temperature of the Ocean itself and of the air above it. There was, however, beyond this the hygrometric condition of the air, of which little was known, and which could only be ascertained by a study of the dry and wet bulb thermometers in the stratum of air reposing on the sea. A fair set of records of these instruments would show whether the sea surface was at the time of observation adding to the store of vapour in the air. Meteorologists ought to ascertain whether the sea surface was or was not above or below the dew-point. Until the birth of clouds was understood, how could their continuance or destruction be discussed with any hope of success?

Captain TOYNBEE said that the chief value of the paper lay in its calling fresh attention to the well-known fact that great changes of temperature were experienced between America and Europe. He hardly thought that the data collected during one passage were sufficient to illustrate the weather of a given month. In the Meteorological Office there were logs of steamers crossing the Atlantic during several years, from which he hoped that useful results would be deduced. He wished especially to mention the logs and beautiful diagrams of Captain Watson, F.M.S., which had been shown on certain occasions at the Society's meetings.

Mr. JINMAN said he could confirm what was said in the paper about the rapid fall of the thermometer in crossing the Atlantic, as he had experienced the same thing repeatedly when passing over the same ground: He had known the thermometer to fall 20° in a very short time, on the wind shifting from SW to NW or NE. It was this fact, as recorded in 'Winds and their Courses,' which led him to doubt the truth of the circular theory of storms as propounded by Piddington, Reid, and others. It was useless collecting data, with the idea that the winds and weather would be found the same in the same locality at the same time of the year.

The Meeting was then adjourned.

RECENT PUBLICATIONS.

AMERICAN JOURNAL OF SCIENCE AND ARTS. Vol. XVIII., July, 1879.

Contains:—Contributions to Meteorology; being results derived from an examination of the observations of the U.S. Signal Service, and from other sources. By Prof. E. Loomis. Eleventh Paper, with two Plates.—The subjects treated of are: I. The Winds on Mt. Washington compared with the winds near the level of the sea. The generalizations arrived at are: 1. In a majority of those cases in which an area of low barometer passes over New England, attended by the usual system of circulating winds at the surface stations, this system of circulating winds does not extend to the height of 6,000 feet; 2. When the depression of the barometer is unusually great, this system of circulating winds extends to the greatest height; 3. When during the progress of an area of low pressure, a system of circulating winds reaches to the summit of Mt. Washington, the change of wind to the east quarter usually begins at the surface stations eleven hours sooner than it does on the summit of that mountain; and the change back from the east to the west quarter usually begins at the base of the mountain five hours sooner than on the summit. II. Abnormal storm paths.

ANNUAIRE DE LA SOCIETE METEOROLOGIQUE DE FRANCE. Tome XXVII., 1879. Bulletin des Séances, feuilles 1-9.

Principal contents:—Résumé des observations centralisées par le Service hydrométrique du bassin de la Seine, pendant l'année 1877, par G. Lemoine.—Note sur les isothermes de l'hiver dans le nord de l'Afrique, par E. Renou.

ANNUAL REPORT OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION, for the year 1877. 8vo.

This contains eleven short Memoirs on Meteorological Subjects, translated, chiefly from the Zeitschrift der Oest. Met. Gesell., by Cleveland Abbe.

British Rainfall, 1878. On the Distribution of Rain over the B Isles during the year 1878, as observed at about 2,000 statio Great Britain and Ireland, with a description of all known forms o recording Rain Gauges. Compiled by G. J. Symons, F.R.S. pp. 216.

In addition to Rainfall and Meteorology of 1878, General Tables of Rainfall, and other information, this work contains articles on the foll subjects :—On Snowfall Measurement, by Col. Ward.—Rotherham Experin Rain-Gauges.—Difference of Rainfall, with Elevation.—Description, with trations, of 28 self-recording Rain-gauges.

Bullettino Meteorologico dell' Osservatorio del Collegio E Carlo Alberto in Moncalieri. Vol. XIII. Nos. 8-12.

These contain an account of the proceedings at the International Met logical Congress, held in Paris, from the 24th to the 28th of August, 1878 also a description, with illustrations, of Padre F. Denza's new self-reco Anemometer and Rain-gauge.

Catalogue des Ouvrages d'Astronomie et de Meteorologie qu trouvent dans les principales Bibliotheques de la Belg préparé et mis en ordre à l'Observatoire Royal de Bruxelles ; suivi Appendice qui comprend tous les autres ouvrages de la Biblioth de cet établissement. 1878, 8vo, pp. 646.

This work extends to 28 of the principal Libraries of Belgium. Ther 3,073 astronomical, and 1,441 meteorological titles; with reference l indicating in what Libraries each work is to be found; and also a very co index.

Contributions to our Knowledge of the Meteorology of the A Regions. Published by the authority of the Meteorological Co Part I. 4to, pp. 40.

This work, which has been prepared by Mr. Strachan, was undertaken the view of collecting together the information as to the climate of the Regions, especially of the portion in the vicinity of the American Conti contained in the log books and journals of the various British Arctic Expedi up to the year 1874. The present part refers to land stations, and co results of meteorological observations made at York Factory, Fort Confid Frederikshaab, Julianeshaab, Batty Bay, and Repulse Bay.

Fraser's Magazine for August, 1879.

Contains a popular article on Weather Forecasting, by J. K. Laughton.

Instructions to Observers connected with the Meteorological vice of the Dominion of Canada. By G. T. Kingston, Superintendent. 8vo, pp. 190.

This work consists of three Parts. In Part I. are given the meaning of in frequent use, and simple statements of sundry physical facts to reference is made in subsequent parts of the volume, or of which a know would be useful in reading works on Meteorology. Part II. is occupied c in details relative to the various instruments, and the precautions to be tak using them and in giving them proper exposure. This part contains also notices on Clouds, certain Optical Phenomena, Aurora Borealis, and Sho Stars. Part III. is principally concerned with the registration of observa There are appended to this work twelve photographs of instruments in posi and a plate with the forms of various clouds.

Journal and Proceedings of the Royal Society of New South W 1878, Vol. XII.

Contains :—Storms on the Coast of New South Wales, by H. C. Ru With four Maps.

MINISTERE DE L'INSTRUCTION PUBLIQUE. BUREAU CENTRAL METEOROLOGIQUE DE FRANCE. INSTRUCTIONS METEOROLOGIQUES. 8vo, pp. 80.

These are the Instructions to the observers at the second order stations of the French Meteorological Office, recently organized, and under the direction of Prof. E. Mascart.

MINISTERO DI AGRICOLTURA, INDUSTRIA E COMMERCIO. UFFICIO CENTRALE DI METEOROLOGIA. METEOROLOGIA ITALIANA. Memorie e Notizie. Anno 1878. Fascicolo IV.

Contains :—Sul Calcolo dell' andamento annuale della Temperatura in Italia, del Dr. G. Grassi.—Sulla Temperatura dell' aria a diverse altezze e sulla riduzione al livello del mare delle altezze barometriche per Dr. G. Grassi.—Sull' osservazione del passaggio degli Uccelli, del M. Amari.—La Temperatura propria dell' aria e lo Psicrometro a ventilatore, del Prof. G. Cantoni.—Su gli Evaporimetri, del Prof. G. Cantoni.

MODERN METEOROLOGY: a Series of Six Lectures delivered under the auspices of the Meteorological Society in 1878. 8vo, pp. 186.

POPULAR SCIENCE REVIEW, July, 1879.

Contains a Paper on the "Birth, Life and Death of a Storm," by R. H. Scott, F.R.S.

RESULTS OF RAIN OBSERVATIONS MADE IN NEW SOUTH WALES DURING 1878. By H. C. RUSSELL, B.A., F.R.A.S., Government Astronomer for New South Wales. 8vo.

This gives the monthly and annual amounts of rainfall and the number of rainy days at 96 stations in the colony; also a table, showing the mean height above summer level of the river Murray, for each month of the year, at Echuca, from July, 1863, to December, 1878. Appended is a map, on which the position of each station is marked by a conspicuous black spot, the diameter of which is proportional to the amount of rainfall.

SANITARY INSTITUTE OF GREAT BRITAIN. ADDRESS UPON WATER ECONOMY. By G. J. SYMONS, F.R.S.

Delivered at the Annual Meeting, July 10th, 1879. 23 pp.

STONYHURST COLLEGE OBSERVATORY. RESULTS OF METEOROLOGICAL AND MAGNETICAL OBSERVATIONS. 1878. 8vo, pp. 62.

Among other information this contains a Table of occasional Phenomena, Agricultural Notes, Observations of Crops and Flowers, of Trees and Shrubs, and of Upper Clouds (Cirrus); also a paper on the Rainfall of the 30 years, 1848-1877.

ZEITSCHRIFT DER OESTERREICHISCHEN GESELLSCHAFT FUER METEOROLOGIE. REDIGIRT VON DR. J. HANN. XIV. Band, May-July, 1879, 8vo.

Contains :—Die Höhe der Maximalzone des Regenfalles im Nordwest-Himalaya und ihre physikalische Begründung, von S. A. Hill.—Ueber die anemometrischen Resultate der amerikanischen "Polaris"-Expedition, von Prof. K. Weihrauch.—Mittheilungen über das neu organisirte Netz meteorologischer Stationen im Königreiche Bayern, von W. v. Bezold.—Klima von Neu-Süd-Wales, nach H. C. Russell.—Ueber Bewegungen auf der Erdoberfläche.—Ueber die Berechnung der Eispunktvariationen der Thermometer, von Dr. J. Pernet.—Ueber die Vertheilung des Regens im Alpengebiet von Wien bis Marseille, von V. Raulin.—Ein neuer Thermograph, nach R. Pictet und G. Cellérier.—Ueber die Bestimmung der wahren Regenmenge mittelst hoch-aufgestellter Regenmesser, von F. E. Nipher.—Die Methoden der Messung der chemischen Intensität des Lichtes, von J. M. Pernter.

DONATIONS RECEIVED FROM APRIL 1ST TO JUNE 30TH, 1879.

Presented by Societies, Institutions, &c.

Adelaide	Observatory	Meteorological Observations, June 1878.
Brisbane	General Registry Office	Report on the Vital Statistics, to April, 1879.
Brussels	Observatoire Royal	Annales Météorologiques, Novem December, 1878, February and 1879.
	” ”	Bulletins Météorologiques, March 1879.
	” ”	Observations faites aux station nationales de la Belgique et d Bas, August, 1878.
	” ”	Catalogue des Ouvrages d'Astron de Météorologie qui se trou Belgique.
	Société Belge de Géographie	Bulletin. Vol. III., No. 2.
Christiania	Kongelige Norske Universitet	On Magnets. By A. O. L. Pihl.
Copenhagen	Danske Meteorologiske Institut	Bulletin Météorologique du Nord. to May, 1879.
Cracow	K. K. Sternwarte	Meteorologische Beobachtungen, May, 1879.
Fiume	I. R. Accademia di Marina	Meteorological Observations, Feb April, 1879.
Greenwich	Royal Observatory	Results of the Magnetical and logical Observations, 1876.
	” ”	Reduction of Photographic Recor Barometer, 1854-73, Dry and Thermometers, 1849-58, and tions of the Earth Therm 1847-73.
	” ”	Report of the Astronomer Roy Board of Visitors, June 7, 1879.
Hamburg	Deutsche Seewarte	Wetterbericht, April to June, 187
	” ”	Monatliche Uebersicht der W March and April, 1878.
Lisbon	Observatoire do Infante D. Luiz	Annaes, Electricidade Atmosphéri
	” ”	La Pluie à Lisbonne.
	” ”	Pression Atmosphérique à Lisbon
	” ”	Résumé Météorologique du Portug
	” ”	Détermination de la Température
London	General Register Office	Weekly Returns of Births and Dea Nos. 13-17, 19-25.
	” ”	Quarterly Return of Marriages, Bi Deaths, March 31st, 1879.
	” ”	Annual Summary of Births, Dea Causes of Death, 1878.
	Meteorological Office	Daily Weather Reports, April to Ju
	” ”	Weekly Weather Reports, 1879. Nos. 13-25.
	” ”	Hourly Readings, September to D 1878.
	” ”	Contributions to our knowledge Meteorology of the Arctic Regions
	” ”	Bulletin quotidien de l'Algérie, Ma to May 31st, 1879.
	” ”	Report of the Permanent Co Meeting at Utrecht, 1878.
	” ”	Rapports sur les Questions du Pro de la Deuxième Congrès Météor International de Rome. Fascicul

London	Meteorological Office	Discours de S. E. M. Augustin Depretis, Président du Conseil des Ministres, prononcé à l'ouverture de 2ème Congrès Météorologique Internationale de Rome.
	” ”	Thirty-one Reports presented to the Meteorological Congress at Rome, 1879.
	Royal Astronomical Society	Monthly Notices, Vol. XXXIX., Nos. 5-7.
	Royal Institution	Proceedings. Vol. VIII., Part 6. Vol. IX., Part 1.
	Royal Society	Proceedings, Nos. 194 and 195.
	Society of Arts	Journal, Nos. 1376-1388.
	Society of Public Analysts	The Analyst, Nos. 37-39.
Madrid	Sociedad Geográfica	Boletin. Tomo VI., Nos. 1-5.
Melbourne	Observatory	Monthly Record of Results of Observations in Meteorology, &c., October to December, 1878.
Mexico	Ministero de Fomento	Boletin. Tomo IV., Nos. 22-61.
	” ”	Resumen general correspondiente al ano de 1878.
Moncalieri	Osservatorio del R. Collegio Carlo Alberto	Bullettino Meteorologico, 1878, Nos. 10-12.
	” ”	Osservazione Meteorologiche, January to March, 1879.
Munich	Kön: Bayern Meteorologische Central-Station	Uebersicht über die Witterungsverhältnisse im Königreiche Bayern. January to April, 1879.
	” ”	Beobachtungen der Meteorologischen Stationen im Königreich Bayern durch Dr. W. von Bezold und Dr. C. Lang, 1879. Vol. I., Part 1.
	” ”	Anleitung für die Aufzeichnungen über Gewitter.
New York	Central Park Observatory	Abstracts of Registers from Self-Recording Instruments, January, March and April, 1879.
Paris	Bureau Central Météorologique	Bulletin Météorologique, April to June, 1879.
	” ”	Instructions Météorologiques.
	Société Météorologique de France	Annuaire. Tableaux Météorologiques, 1878. Feuilles 4-8.
Prague	K. K. Sternwarte	Astronomische Magnetische und Meteorologische Beobachtungen im Jahre, 1878.
Rome	Ministero della Pubblica Instruzione	Bollettino Mensile, October and November, 1878.
	” ”	Meteorologia Italiana, Memorie e Notizie Anno 1878, Fascicolo III.
	” ”	Rivista Meteorologica, May 1879.
	Osservatorio del Collegio Romano	Bullettino Meteorologico, December, 1878.
Stonyhurst	Observatory	Results of Magnetical and Meteorological Observations, 1878.
Toronto	Meteorological Office	Instructions to Observers at the first, second and third class stations. By G. T. Kingston, M.A.
	” ”	On the Reduction of the Barometer to Sea Level, with Tables. By C. Carpmael, M.A., F.R.A.S.
Upsala	Observatoire de l'Université	Bulletin Météorologique Mensuel, July and August, 1878.
	” ”	Hageifallet i Upsala den 25 Juli, 1872, af Dr. S. A. Hjelström.
	” ”	Cirkulär till de af Länens Kongl. Hushällnings-Sallskap utsedde Meteorologiske Observatörer.
Vienna	K. K. Centralanstalt für Meteorologie und Erdmagnetismus	Beobachtungen, February to April, 1879.
	Oesterreichische Gesellschaft für Meteorologie	Zeitschrift, April to June, 1879.
Washington	War Department	Monthly Weather Review, February to April, 1879.

Wellington ..	General Register Office ..	Statistics of the Colony of New Zealand, 1877.
Wellington College	Natural Science Society	Ninth Annual Report, 1878.

Presented by Individuals.

Barham, Dr. C.	The Winter of 1878-9.
Clark, E., F.R.A.S.	A Visit to South America.
Compton, Dr. T. A.	Memoranda of the lowest temperature experienced at Bournemouth and forty-five other English Stations during the great cold of December, 1878.
Doyle, P., F.S.S.	A Contribution to Burman Mineralogy.
Dunlop, W. H.	Results of Meteorological Observations made at Annanhill, Kilmarnock, March and April, 1879.
Goslin, S. B.	How to Avert or Mitigate Famines and Droughts.
Greaves, C., F.G.S.	Keith Johnston's Physical Atlas of Natural Phenomena, 1848.
„	Voyages dans les Alpes précédés d'un Essai sur l'Histoire Naturelle des environs de Genève, par Prof. H. B. de Saussure, Tomes I.-VIII.
„	Modern Meteorology, a Series of Six Lectures delivered under the auspices of the Meteorological Society in 1878.
Hankinson, R. C.	Weather at Red Lodge, Southampton, March to May, 1879. (MS.)
Hann, Dr. J.	Die tägliche Periode der Geschwindigkeit und der Richtung des Windes.
Hoskins, Dr. S. E., F.R.S.	Meteorological Observations, Guernsey, March to May, 1879.
Jenkins, B. G., F.R.A.S...	Note on the Terrestrial Magnetism.
Mawley, E.	The Weather of the past Seven Months (November, 1878, to May, 1879) in the neighbourhood of London.
Pigott, Mrs.	Meteorological Register kept at Abingdon Pigotts, Royston, by the late G. G. G. F. Pigott, F.R.A.S., 1864-77. (MS.)
Preston, Rev. T. A., M.A.	Wiltshire Rainfall, March to May, 1879.
Prince, C. L., F.R.A.S.....	Observations upon the temperature of the late Winter and Spring, 1879.
Reyes, V.	La Ley de Periodicidad de las Lluvias en el Valle de Mexico.
Robinson, Rev. T. R., D.D., F.R.S.	On the Determination of the Constants of the Cup Anemometer.
Rous-Marten, C., F.R.G.S.	Fourth Report upon the experimental system of storm-warning in New Zealand, by Commander R. A. Edwin, R.N.
Russell, H. C., B.A., F.R.A.S.	Storms on the Coast of New South Wales.
Sabine, Sir E., F.R.S.	British Association Reports, 1853, 1856, 1872 and 1873.
Silver, S. W., F.R.G.S.....	The Colonies and India, Nos. 346-357.
Spooner, W. C.	The Seasons and the Crops: their Mutual Relation.
Symons, G. J., F.R.S. ...	Symons's Monthly Meteorological Magazine, April to June, 1879.
„	British Rainfall, 1878.
The Editor..............	Academy. Nos. 361-373.
„	Nature. Nos. 492-504.
„	The Sanitary Record. Nos. 249-261.
„	The Telegraphic Journal and Electrical Review. Nos. 148-150, 152, 153.
Tripp, W. B.	Meteorological Registers for 1878, kept at Burton-on-Trent by C. U. Tripp, M.A., and at Altarnun Vicarage by C. N. Tripp.
Ward, Col. M. F., F.R.A.S.	Le Triple Almanach, Mathieu (de la Drome).
Whitmore, Dr. J.	The Health and Meteorology of Marylebone, March to May, 1879.
Wilson, Dr. J. M.	Annual Report of the Medical Officer of Health for Rochdale, 1878.
Woeikoff, Dr. A.	Remarques sur les Isobars de Janvier et de Juillet.

QUARTERLY JOURNAL

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OL. V. No. 32.

III. *On Observations on the Velocities of Winds, and on Anemometers.* By G. A. Hagemann.

[Received March 31st.—Read May 21st, 1879.]

HE velocity of the wind, notwithstanding its very great importance to eteorology, is not generally given by real measurement; and, even where struments are used, these will, on examination, be found to be of but little lue, and their indications are therefore not much more trustworthy than ose derived from good and practical estimation. It is in order to call e attention of meteorologists to this branch of their study, that the author s undertaken a critical examination of the present state of observations de on the velocity of the wind, registered at the Meteorological Offices; of ich examination the following paper gives a brief account.

By far the greatest number of observations on the velocity of wind are rived from estimation; it is therefore essential to form an idea of: 1. Who e the observers? 2. What guides them in their estimates? 3. To what proach to exactness are the estimates carried?

As wind is of far greater importance to navigators and to people dwelling ar the coast than to those who live inland, it is only natural that most of the servers should be seamen, or at least have been sailors, pilots or fishermen, o, with long experience in the battle against the winds, have been able to m for themselves a standard scale by which the velocity of the wind may expressed, and who, in communication with others, having the same perience as themselves, are able to convey their observations to them.

But all these observers have not the same experience. One has been oast trader, another an ocean traveller; one has been a fisherman, ther has obtained his experience on board a man of war; one has served in the tropics, another in the arctic seas; the one in a sailing vessel, the other on board a steamer:—and all these different schools have given them different experiences and different standards for their estimates. A wind with a velocity of say 20 metres per second has a considerably greater effect in the arctic regions, where it is perhaps followed by snow, rain or hail, than the same wind will have for a tropical observer; on the coast its action is different from what it is in the open sea; and on land its action is again different. The disposition and mental state of the observer have also their influence on his estimation. A woman, who—as the author has seen—is the observer in some places, has a lower scale for her estimates than a strong man; and so on: the estimates of the velocity of the wind have the same faults as all estimations—they are personal.

The observers are guided in their observations by the effect the wind has upon the water, the sails, trees and so on; but this effect, as may easily be seen, is dependent not only on the velocity of the wind, but on its momentum; and must therefore change with the moisture, temperature and barometrical state of the atmosphere; and the action of these agents is much greater than is generally thought. The amount of sail which a vessel can carry is one of the best means of guidance to the observer; but the sails are exposed to the momentum of the wind; and the estimation will therefore not be that of the velocity alone.

Again, there is always some little time before the effect of the wind is fully developed: the waves do not rise immediately; and the rough sea does not fall as soon as the wind ceases. The directions of the wind, if a head (as on board a steamer), if a beam, if abaft, influence the amount of sail a vessel can carry, and mislead the estimation; not to speak of that natural courage of the captain and other mental dispositions which are important factors in the carrying sail on a vessel.

In spite of all that has been remarked, it can nevertheless not be denied that estimation may be carried very far in exactitude; and that where the object is only to determine the velocity of the wind within the grades of the Beaufort scale, a good estimation will be quite satisfactory; but only with respect to winds of a low velocity,—winds which permit the vessel to carry sail. As soon as this limit has been reached,—that is, beyond about 7 in the Beaufort scale,—no further estimation can be given; as the author has often experienced: and it is particularly high winds of which the force ought to be known. It is also evident, that no real estimation can be given on gusts of wind (squalls), or, speaking generally, on those variations in velocity which are always to be found in even the most steady winds, and which probably have to be accounted for by the friction of the winds on the surface of the water or the earth over which they pass.

Recapitulating what has been remarked, it will be seen:—1. That estimation gives not the velocity of the wind, but its momentum. 2. That it gives only the general features, and not the variations of the wind; and 3. That all estimates stop at 7 of the Beaufort scale, which is equivalent to a velocity of about 15 metres per second.

The instruments constructed to find the velocity of the wind are of two classes:—1. Those by which it is attempted to derive the velocity of the wind from its pressure, *i.e.* those which act by the momentum of the wind; and 2. Those in which the compression or suction produced on the air by the wind is taken as the measure of its velocity. To the first class belong the greatest number of instruments, of which may be here mentioned—the Robinson Anemometer, consisting of four hemispheres or cups, placed on a cross, capable of revolving on a vertical axis. The author has not had access to the printed theory for this instrument, which is the anemometer now universally adopted by general consent: nor will he here give the mathematical theory, which involves no great difficulty, but will only state, that the cups are caused to revolve by the momentum of the wind, and therefore *do not give its velocity*. So far as the author's knowledge goes, there are no means of verifying the Robinson Anemometer, or of correcting its inexactitude; as all attempts which have been made by placing the instrument on locomotives, or revolving boards, give very unsatisfactory results, caused by the surrounding air, to a certain extent, taking part in the motion; whilst, on revolving boards, the centrifugal force also greatly disturbs the experiment. But even if it had no mechanical faults, the Robinson will not, in any case, give directly the velocity of the wind; and the result will, at all events, have to be corrected, according to temperature, moisture and barometrical pressure. The momentum of the wind being the motive power, the results of the instrument will, even supposing the moisture of the air not to affect it considerably, be dependent on the mass of air which strikes the cups in a certain time. If this is called a, at 0° (Centigrade) of temperature, and 760 mm. barometrical pressure, the indication of the Robinson will, at the temperature t and barometer b, have to be corrected by

$$a.\frac{b}{760(1 + \cdot 00376\, t)}.$$

Supposing one storm to be measured in the tropics, with 750 mm. barometric pressure, and temperature $t = 30°$ C.; and another in the arctic regions, with $b = 750$ mm. and $t = - 10°$, the correction of the Robinson anemometer in the first case would be $0 \cdot 9\, a$, in the second $1 \cdot 02\, a$, giving a difference of not less than 12 per cent. in the indications of the instrument. But such corrections will be much greater still when the pressure and moisture are taken into consideration; and there is no information whatever as to the influence of rain, snow or hail on the revolutions of the cups.

The velocity of the wind is derived from the number of revolutions of the Robinson cups in a certain time; consequently the momentary velocity is not found, but is hidden under the average velocity during the time of observation. This too will be seen to be a great fault, which, however, would easily be overcome by measuring, not the number of revolutions the cups make, but the force which would be required to prevent their revolving. In this case, in order to give all wind directions a fairer chance, there ought probably to be eight cups instead of four; and the perpendicular shaft should, at its lower end, carry a pulley, on which should be fastened a fine wire, connected at its other end with a spring.

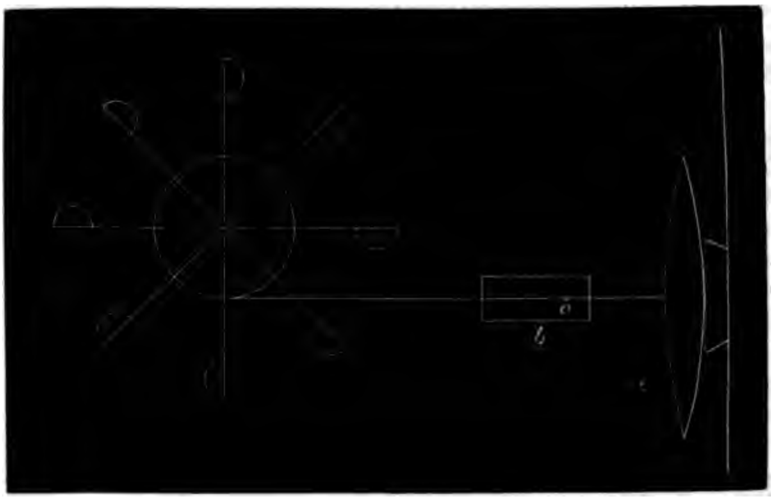

Fig. 1.

If a marking pointer were fastened on the wire at *a* (fig. 1), this would register the force of the wind on a revolving cylinder *b*, and would, no doubt, be an improvement on the Robinson Anemometer; but its results would still be incorrect, and its further application in meteorology unadvisable.

The author has spoken more particularly of this instrument, because its faults are to be found in all other anemometers of the same class. The Wild Anemometer, the Dutch Anemometer, and others have, besides this source of error, great inconvenience in their application, and are therefore but little known and hardly ever used.

To the other class of anemometers belong the Lind and the Hagemann Anemometers. The first is an imperfect instrument,—imperfect in its conception. The inventor's idea was to measure the compression which the wind produces when caused to blow into an open tube (a Pitot's tube). A glass tube was formed, as in fig. 2, the open end *a* was turned against the wind, while the other end *c* was imperfectly protected against the action of the wind by a plate *b*.

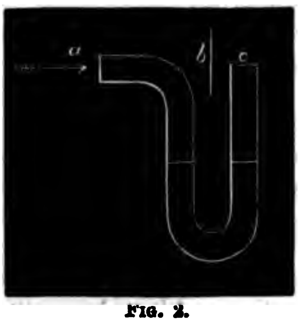

Fig. 2.

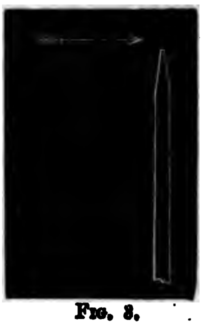

Fig. 3.

From the pressure, indicated by the water in the lower part of the tube, the velocity of the wind was found. Mr. Lind gives no theory of his instrument, and the scale is only one of inches and lines. The cause of the imperfection of this Anemometer will now be noticed.

The Hagemann Anemometer is of two different constructions—one for stationary, another for ships or travelling observations, but both are founded on the same theory. When the wind is blowing into an open tube, or a funnel turned against it, the air in the tube will, when its other end is closed, be compressed; and the compression is carried on so far that there will be an equilibrium at the mouth of the tube. If the wind should now suddenly stop, the compression of the air in the tube will cause it to flow out again with the same velocity as that by which the compression is produced—the air being an elastic body. When the air is compressed in a vessel by a water pressure of h mm., its velocity in flowing out from this vessel, through a hole in a thin plate, is $v = 3{\cdot}9 \times \sqrt{h}$ metres per second, which is therefore the velocity of wind able to produce the compression h. And again, when the wind is caused to sweep over an open perpendicular pipe (fig. 3), it will produce a suction in this pipe, which will be found to be just as great as the pressure, when blowing into an open tube turned against it; and if this suction is called h, the velocity of the wind will again be expressed by $v = 3{\cdot}9 \times \sqrt{h}$ metres per second, h being measured in millimetres of water suction. Further information regarding the experiments made with these tubes may be found in the Annual Report of the Danish Meteorological Institute for 1876.

By combining these two actions, *i.e.* lengthening the vertical end *c* of the Lind anemometer, and taking away the protecting plate *b*, the Hagemann travelling anemometer is produced (see fig. 4).

In the one tube the wind causes a pressure equal to h mm.; in the other a suction also equivalent to h mm; and the wind velocity is therefore

$$v = 3{\cdot}9 \times \sqrt{\frac{h}{2}} \text{ metres per second.}$$

A scale is arranged in such a manner that it may easily be moved up and down: the zero is placed at the surface of the water in the left-hand tube, and on the right-hand side the velocity of the wind may be read directly.

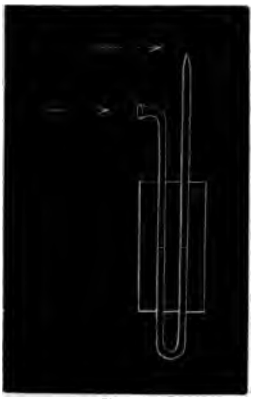

FIG. 4.

FIG. 5.

Knowing the effect of the wind on an open tube, the imperfection of the Lind anemometer will now be evident. However well the open tube *c* is protected, there will constantly be some rarefaction of the air in it, and this will disturb its accuracy. Had Lind only abandoned the protecting plate, and made the perpendicular pipe a little longer, he would have produced a very useful instrument.

For stationary use, the Author has constructed another instrument, using only the rarefaction produced by the wind on an open perpendicular tube. This tube is generally a piece of ordinary gas pipe, ¼ to ⅜ inch in diameter, and is either fastened to a mast or on a prominent place, such as a high chimney or a church tower. The pipe has at the top a gilt brass mouthpiece, with an opening of not less than 3 mm. (fig. 5).

Downwards, the pipe is carried to almost any length, and in any shape, to the observatory where the anemometer, properly called, is found. This consists of a vessel A about half full of pure water; from the bottom of A, a pipe *a* enters and opens above the water surface: *b* is a small gasometer, which dips into the water; it is made of very light tinned sheet brass, and has an upper surface of exactly 100 sq. cm. The gasometer is hung by a strong silk thread, which, after first having passed over the pulley *c*, connected by a wheel with an index hand, has its other end fastened to a spring *d*, properly tempered (fig. 6).

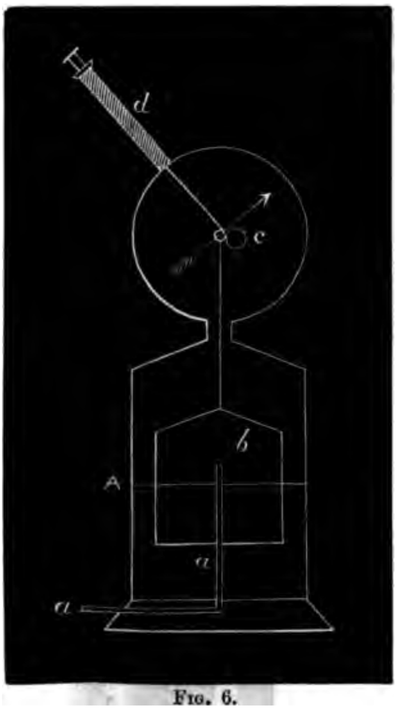

FIG. 6.

If now the gas pipe is connected with the pipe *a* by means of a gutta percha pipe, the effect will evidently be that an increase or decrease in the rarefaction will turn the hand. A rarefaction of 1 mm. water pressure will act as if a layer of 1 mm. of water were laid on the whole surface of the gasometer; which on 100 square centimetres is a weight of 10 grammes.

Hence, by loading the gasometer with 10, 20, 30...100 grammes, the position of the hand will show its position corresponding to 1, 2... 10 mm. suction, and the scale is divided accordingly. A scale for velocity of wind, in metres per second, is calculated by the formula $v = 3{\cdot}9 \times \sqrt{h}$, and is also marked. The velocity of the wind is, so to say, weighed, and may, by a proper scale, be determined with greater approximation than with this simple spring. But in the present condition of the instrument, its action is perfectly satisfactory. Neither temperature, pressure, moisture, rain, snow nor hail has any influence on it; its construction is as simple as possible, it can be set up in any convenient place, where it may be read day and night, and where a self-registering appliance may be readily connected with it. Then the apparatus, particularly if the pipe is not too long—say not over 50 feet—acts almost instantly, and will follow the wind in all its variations of velocity. Should any one wish to find the average velocity of the wind, this may be done by introducing a capillary tube or an air chamber of some considerable size into the gutta percha connection pipe. The instrument seems to fulfil all that might be expected from a good wind-gauge. The mechanical parts may undergo some improvements; but even in its present state, its indications are perfectly satisfactory.* A self-recording arrangement is easily applied to it, but where this is not wished, a maximum and a minimum hand will give the highest and lowest wind velocities between the observations.

The question, however, now arises how to apply these instruments in order to get observations of any value ; and this question will occur more forcibly to those who have seen the Hagemann Anemometer in operation. A pipe mounted on a mast 20 feet above an ordinary dwelling house, and connected with the Anemometer, gives very unsatisfactory results; particularly if other houses, trees or similar obstacles to the wind are in the neighbourhood: the hand of the Anemometer swings to and fro, and hardly ever is at rest. This shows that the wind current has been broken up by friction against the earth, and by those changes in its force and direction, which always result from its striking against roofs, buildings, trees, and so on.

But where this is the case, the Robinson Anemometer, giving only the average velocity of these broken and disturbed winds, is really of but very small value to science. When, however, the perpendicular tube is made so high, that its open end is acted upon by undisturbed winds, the index hand of the anemometer comes to rest; though not to absolute rest, as it follows all the changes in velocity, which many winds are constantly undergoing, even at this height. It is impossible to say how high the tube should be: local circumstances must be taken into consideration; but about 50 feet above the highest tree or building in the neighbourhood will, in most cases, answer the purpose.

On board ship, particularly in steamers, the pipe ought to be fastened to the mast, and the anemometer be hung, like lamps and compasses, on gimbals. But in all cases, whichever instrument is used, it does not give the velocity of the wind, but the resultant of the speed of wind and the speed of the vessel. If *ab* (fig. 7) represents the speed and direction of the vessel, *ca* the direction in which the wind is felt, and the velocity measured by the anemometer, then the true velocity of the wind will be *da*, which is much less than what is measured on the anemometer.

If the wind be fair, and the speed of the vessel be represented by *ge* and

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* At the Congress now being held at Rome, Capt. Hoffmeyer, from Copenhagen, will show the Hagemann Anemometers, which are manufactured by Nyrop in Copenhagen.

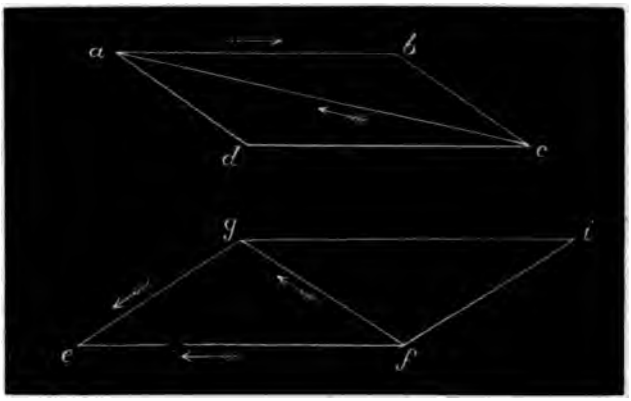


FIG. 7.

the apparent direction and velocity of the wind by fg, then the true direction and velocity of the wind are shown by ig.

Seeing the influence which the motion of the ship has on the apparent direction and velocity of the wind, it will be better understood how difficult it is on board ship to form an estimate of wind velocities; and though the movement of the vessel by the waves has a disturbing influence on the anemometer, it is not more than can be easily understood and taken into consideration by an observer possessing a little experience.

As an almost universal scale for velocity of wind, the Beaufort scale has been adopted; besides this, the velocity of the wind in England and in the United States is given in miles per hour, and on the Continent it is given in metres per second.

The author would urgently recommend the introduction of the latter into all meteorological registration; and the more so as "miles per hour" can be found with sufficient accuracy for public use by multiplying the number of metres per second by 2: thus a velocity of 18 metres per second is almost the same as a velocity of 36 miles per hour. The transformation for public information would thus cost but very little labour; and science would have gained a universal registration. The Beaufort scale ought not to be used any more, not even for charts; but a new scale divided into 25, which would be better proportioned to the effect of winds of different velocities, should be introduced in its stead for charts and naval use. The velocity of the wind being $v = 3{\cdot}9 \times \sqrt{h}$, it is clear that h, denoting millimetres of water pressure, *represents the real effect of the wind* on sails, buildings, &c. A wind, with a velocity equivalent to $h = 5$ mm. would act on a sailing vessel or a windmill as if 5 mm. of water were laid on the whole surface of the sails; a wind giving $h = 10$ mm. would act as if the sails were pressed with 10 mm. of water pressure; and so on. The author would therefore recommend the introduction for general use of a scale:—

1. Being all winds below $v = 3{\cdot}9\sqrt{5}$, equal to 8·69 metres per second, or 17·58 miles per hour.

2. Winds below $v = 8{\cdot}9\ \sqrt{10}$; that is, 12·32 metres per second, or 25 miles per hour.

3. Winds below $v = 8{\cdot}9 \times \sqrt{15}$; 15 metres per second, &c.

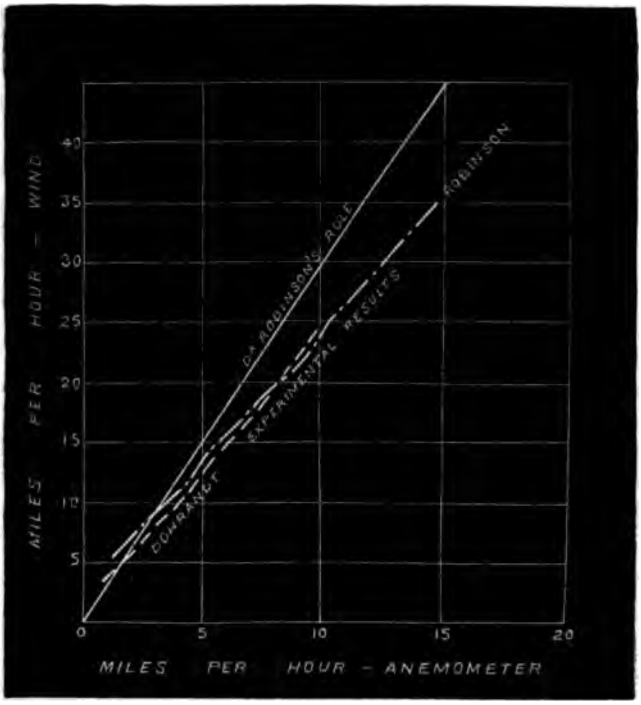
He is not blind to the circumstance that the lower velocities of winds, which are the most common, receive only a few grades; but these have in reality little interest. The navigator can carry fewer or more sails, make more or less speed by the first two new classes, which take up so large a part of the Beaufort scale (0—6); but those winds do not endanger his vessel; have no interest in his logs; and even less interest for the meteorologist. But winds with higher velocity, higher pressure, endanger the vessel, and should appear in the log; though hitherto this has not been so.

It would be of general interest to see in a ship's log the wind recorded as 2, but the maximum hand for a squall to be indicating 8, meaning $v = 8{\cdot}9\ \sqrt{40} = 24{\cdot}6$ metres per second. The public would feel "8" to express a wind having an effect 4 times as great as that of the first, which would probably be known by personal experience; and the meteorologist would get information of value to him.

DISCUSSION.

Mr. Field said that the question of anemometers and instruments for registering the velocity of the wind was in an extremely unsatisfactory condition. When Dr. Robinson introduced his cup-anemometer, nearly 30 years ago, he stated that the cups moved with one-third of the real velocity of the wind, and that this ratio was irrespective of the sizes of the cups or lengths of the arms. Cup-anemometers were thenceforth constructed in accordance with this rule, which appears to have remained unquestioned for nearly 20 years, when the Rev. F. W. Stow made a number of experiments with anemometers of different sizes, and found that they did not agree even approximately with the Kew pattern. In a paper giving the results of these experiments, published in the Quarterly Journal of the Meteorological Society, Vol. I., he also makes this pertinent remark:—"As our confidence has been rather rudely shaken in one respect, we perhaps need reassuring that the relation between the wind and the cups is not equally mythical." In 1874 M. Dohrandt made an extensive series of experiments at St. Petersburg by resting the cup-anemometers in a whirling machine, and came to the conclusion that the ratio differed greatly in anemometers of different sizes, and that 3 to 1 was hardly ever the right ratio. In 1876 Dr. Robinson read a paper before the Royal Irish Academy, in which he found fault with M. Dohrandt's experiments and results, but incidentally made the very important admission that the ratio differed in anemometers of different sizes. Last year, 1878, both M. Dohrandt at St. Petersburg, and Dr. Robinson at Dublin, carried out independently an extensive series of experiments with whirling machines. M. Dohrandt's experiments (published in the 'Repertorium für Meteorologie,' Band VI.) confirmed his previous experiments, and showed that the ratio of 3 to 1 is wrong. Dr. Robinson's experiments, on the other hand (published in the 'Philosophical Transactions'), contradicted his previous conclusions, and showed that the value of the ratio varied not merely in different instruments, but in the same ones when moving at different velocities, and that the limiting value was probably 2·286 to 1 instead of 3 to 1. Both Dohrandt and Robinson tested the Kew pattern anemometer, and their experimental results agreed in a remarkable manner, and both differed greatly from Dr. Robinson's rule as shown by the annexed diagram (p. 212).

Another important point appeared to be unsettled. Hagemann in his paper stated that the ratio must vary with the density of the air, and therefore be incorrect unless corrected for density. Dr. Robinson, on the other hand, in his original paper, made the ratio independent of density, and stated that he had



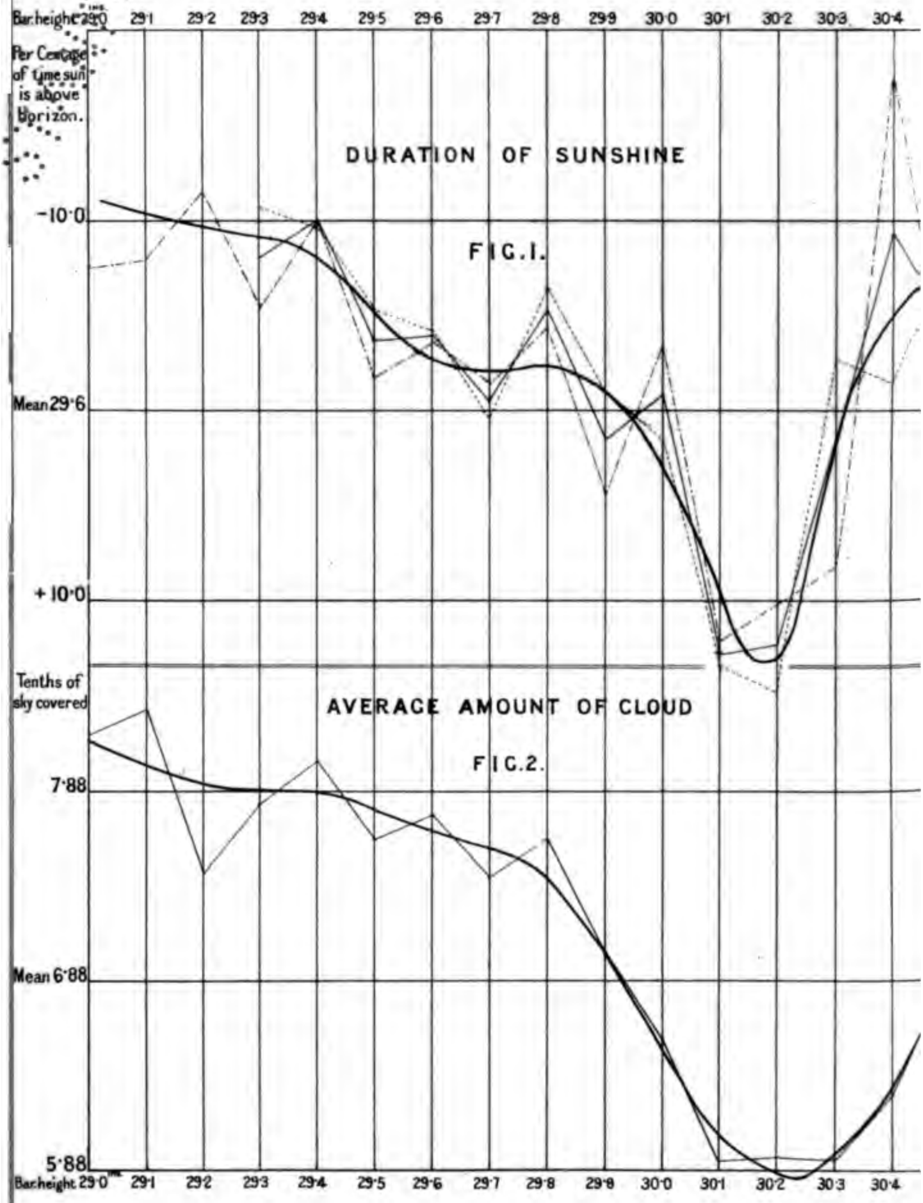
Robinson's Cup Anemometer.

actually tried the cup-anemometer in *water* and obtained the same results as when it was tried in air. In his last paper, on the contrary, he stated that the ratio varied with the density, and gave corrections for the density. On the whole the question was in as unsatisfactory a condition as well could be; and when it was considered that the records of the standard cup-anemometer at Kew were reduced by the admittedly incorrect rule of 3 to 1, so that incorrect results were obtained, and that all the anemometers sent to Kew to be tested were tested by comparison with these incorrect results, the state of affairs must be considered far from creditable to meteorologists. What rendered it worse was, that the results obtained by this incorrect rule could not in many cases be afterwards corrected, as the correction varied with the velocity of the wind from time to time, whereas the records were in many cases taken in total miles run during a whole day. In this state of affairs any simple anemometers which offered a prospect of enabling the cup-anemometers to be checked would be welcomed. Hagemann's new anemometers appeared to offer such a prospect. That gentleman had two anemometers, one somewhat like Lind's, which Mr. Field would not further refer to, and another consisting simply of a pipe with an open end exposed to the wind. This latter instrument was a novelty, and had peculiar interest for him, as he had occasion last year to try some experiments on the up-draught created in pipes with open ends exposed to the wind. A committee, of which he was a member, was appointed by the Sanitary Institute of Great Britain to test various cowls. The experiments were carried out at Kew Observatory by permission of the Kew Committee, and it was found that plain open pipes without any cowl gave as strong an up-draught as the pipes with cowls. This up-draught was produced when the temperature was the same inside the building as outside, and varied with the velocity of the wind, showing that it was caused by the suction alluded to by Hagemann and utilised in his new anemometer. Mr. Field was therefore of opinion that the principle of this anemometer was correct; but whether the precise value of the ratio between the wind and the suction given by Hagemann was correct, he was not prepared to say. A special fund was being raised to

RELATION BETWEEN THE HEIGHT OF THE BAROMETER THE DURATION OF SUNSHINE AND THE AMOUNT OF CLOU AS OBSERVED AT KEW OBSERVATORY.

Fig. 1. { ____ *Per Centage of Sunshine for 1877.*
...... *Do.* ...... *Do.* ...... *1878.*
____ *Mean of 1877 and 1878.*

Fig. 2. ____ *Observed amount of*



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carry on additional experiments on cowls and pipes, and the committee were now engaged in testing the anemometers employed by means of a novel process. A known volume of air was expelled from an accurately gauged gasholder, and the same volume was also measured by the anemometer to be tested, and the reading compared with the true result. He thought that these experiments could not fail to throw further light on the matter, but the extent to which they were carried would depend on the amount of funds raised. The committee appointed to test cowls, had ordered one of these instruments for the purpose of experimenting with it.

Captain **Toynbee** said that Captain Watson had recorded observations made with a small hand anemometer presented to the Meteorological Office by M. Hagemann, and at the same time with one of Lowne's, and with a cup-anemometer; the results agreed in a remarkable way. At his request Captain Watson let his officers try to use Hagemann's on a passage between Liverpool and Queenstown, and wrote as follows:—

"Queenstown, May 18th, 1879.

"I have let my officers try to use Hagemann's anemometer, but the result was not a success; all complained of the 'pumping.' You must remember that I have been at this work for so long a time, that by looking at the water I can tell within 3 miles what the velocity of the wind is; and in using Hagemann's anemometer, the reading may to some extent have been influenced by that knowledge, though I have done all I could to give the thing a fair test. However, I will give my officers another chance, and see what the result is."

Captain Toynbee thought that the simplicity of the instrument was greatly in its favour, as it was almost impossible for it to get out of order, and he hoped that satisfactory results might be obtained from it.

Mr. **Whipple** was sorry that Mr. Field should say that all anemometer observations were wrong. Every one knew that Dr. Robinson's rule was not correct. He would like to know why M. Hagemann said the observations of the force of the wind were not correct above force 7, or 30 miles per hour. He did not see how the force of the wind could be obtained by placing a 50-feet tube in a perpendicular position, so that the wind blew over the mouth. Strong winds would probably cause sonorous vibrations in the tube, rather than transmit pressure to a gauge at the base.

Mr. **Laughton** wished to say a word on behalf of the Beaufort scale, which he thought M. Hagemann had unduly disparaged. It was, of course, desirable in the interests of meteorological science that the relation between the Beaufort scale and the velocity of the wind should be established: an exact comparison might then be possible between observations afloat and ashore, which was now impossible. But in speaking of the Beaufort scale, it must be remembered that it was fashioned by a sailor for sailors, and that it made no pretence of estimating the velocity of the wind, although M. Hagemann seemed to have thought it did. It was certainly new to him, it would be new to every seaman, to learn that the Beaufort scale could not take cognisance of winds above force 7; or that winds below that force—winds the study of which taught the navigator to make good passages—had no interest in a ship's log. He would not say that the Beaufort scale was everything that could be wished; but there was nothing better in existence; and he thought that M. Hagemann's condemnation of it was based on an imperfect knowledge of its real aims.

XIV. *On the relation between the height of the Barometer, the duration of Sunshine, and the amount of Cloud, as observed at the Kew Observatory.* By G. M. Whipple, B.Sc., F.R.A.S., F.M.S., Superintendent of the Kew Observatory. (Plate XXVI.)

[Received April 9th.—Read May 21st, 1879.]

The thought has occurred to me more than once, that it might be interesting to inquire to what extent the old inductions embodied in the notation upon weather glasses or dial barometers were founded upon fact; and an opportunity having offered itself in the discussion of sunshine observations, I made use of it to see whether or not the state of the sky in the neighbourhood of London agreed with the formula, which stands usually as follows:—

At 30·5 ins., set fair; at 30·0 ins., fair; at 29·5 ins., change; at 29·0 ins., rain; and at 28·5 ins., much rain.

As it is difficult to get at any result by examination of the rainfall statistics, on account of the disturbance caused in these calculations by occasional exceptionally severe local showers, such as occurred on several occasions in 1878, it may be better to read the inscription modified thus:—

At 30·5 ins, sky clear; at 30·0 ins, few clouds; at 29·5 ins, average number of clouds; at 29·0 ins., cloudy; and at 28·5 ins., very cloudy.

Now at Kew we have two ways of examining the truth of the statements embodied in the above formula; we may take the Sunshine-record traces, which show the absolute duration of sunshine every day; or we may take the amount of cloud, as determined in the usual manner, five times daily by estimation by the observers. For corresponding barometric heights we may either make use of the mean of the 24 hourly readings of the barograms, or the mean of the 5 eye observations reduced to the mean of the day by Glaisher's tables of diurnal range. As the former method entails a considerable amount of calculation, I have, throughout the investigation, employed the results given by the latter method only, having them already prepared to hand.

Duration of Sunshine.—In order to free the inquiry from the complexity entailed by seasonal change in the duration of sunshine, the first step was to determine for every day in the two years 1877 and 1878, the only years available for this discussion, the ratio of the time of recorded sunshine to the time during which the sun was above the horizon, or, as it has been elsewhere expressed, the percentage of greatest possible duration of sunshine.

Columns having been drawn and marked respectively 29·0, 29·1...30·6 ins., the ratios were distributed according to the average height of the barometer for the day on which they were determined, and the means calculated. These, together with the number of observations available, are given in Table I. The means of the two series show that at Kew the actual sunshine observed in 1877 was 30·2 per cent., and in 1878, 29·0 per cent. of the greatest possible amount. In the same Table there are also given for each 0·1 in. of barometric pressure, the differences from both the annual means and from the mean of the two years. It will be seen from the distribution of the + and — signs that with a high barometer the amount of sunshine is greater than with a low one, up to the limit of 30·3 ins; but that above that pressure the law does not hold good.

On Plate XXVI., Fig. 1, the two series of results are superimposed, and a broad line freely drawn through them gives a curve, which may fairly be assumed to represent the law of the distribution of sunshine with barometric pressure at Kew. It is not to be understood that the curve will apply to other places directly as it stands; for undoubtedly its change in direction at about 30·3 ins. is in a great measure to be attributed to the haze and

TABLE I.

Barometer.	Sunshine.							Cloud.				
	Percentage of Possible Amount.		No. of Days observed.		+ or — Annual Mean.			Average Diff. from Mean Amnt.	No. of Observations.	Year.	Mean Amount.	Difference from Mean of 10 years.
	1877.	1878.	1877.	1878.	1877.	1878.	Mean.					
Ins.												
29·0	22·6	..	6	..	— 7·6	..	..	+1·30	14	1869	6·92	+0·04
·1	22·2	..	4	..	— 8·0	..	..	+1·42	19	1870	6·39	—0·49
·2	19·6	..	8	..	—11·6	..	..	+0·55	45	1871	6·68	—0·20
·3	24·9	18·3	10	10	— 5·3	—10·7	— 8·0	+0·92	64	1872	6·85	—0·03
·4	20·0	19·2	9	20	—10·2	— 9·8	—10·0	+1·14	100	1873	6·87	—0·01
·5	28·4	23·5	9	27	— 1·8	— 5·5	— 3·6	+0·74	122	1874	6·55	—0·33
·6	26·7	24·7	30	22	— 3·5	— 4·3	— 3·9	+0·87	133	1875	7·32	+0·44
·7	28·8	29·4	31	35	— 1·4	+ 0·4	— 0·5	+0·56	136	1876	6·96	+0·08
·8	26·0	22·5	40	39	— 4·2	— 6·5	— 5·3	+0·76	172	1877	6·98	+0·10
29·9	34·5	27·8	50	40	+ 4·3	— 1·2	+ 1·5	+0·19	202	1878	7·31	+0·43
30·0	26·7	30·4	55	52	— 3·5	+ 1·4	— 1·1	—0·30	219	..	..	..
·1	42·3	42·4	42	41	+12·1	+13·4	+12·7	—0·93	195	..	..	..
·2	40·7	43·6	31	21	+10·5	+14·6	+12·5	—0·93	147	..	..	..
·3	38·4	26·2	16	23	+ 8·2	— 2·8	+ 2·7	—0·95	169	..	..	..
·4	12·9	27·5	7	11	—17·3	— 1·5	— 9·4	—0·60	101	..	..	..
·5	29·0	20·6	3	10	— 1·2	— 8·4	— 4·8	0·00	48	..	..	..
30·6	12·6	23·0	5	7	—17·6	— 6·0	—11·8	+0·13	21	..	..	..
Mean	30·2	29·0	..	..	..	..	..	..	..	..	6·88	..

cloud which at Kew accompany the east wind so frequently prevalent during periods of high barometric pressure or anticyclones. The effect of this wind upon the duration of sunshine has been already pointed out in the Quarterly Journal, Vol. IV. p. 203.

Amount of Cloud.—The proportion of cloudy sky to clear sky has been regularly noted for many years at Kew as one of the eye observations. The scale adopted is the ordinary one of 0 clear sky, 10 overcast. It was first intended to discuss five years observations; but as it appeared, on the completion of the series 1874-1878, that the numbers available at the extreme high and low pressures were hardly sufficient for a basis upon which to form a sound deduction, two additional years, 1872 and 1873, were discussed, and afterwards three others, 1869, 1870 and 1871, bringing the numbers at the ends of the scale more in conformity with those at the centre. Taking the whole of the observations for each year, the absolute annual mean amount of cloud was determined for the year independently of barometric pressure. These values are given in Table I., and it may be incidentally remarked, that, as they stand, they appear to indicate a tendency to a periodicity akin to sunspot variations, the relatively clear sky period coinciding with a year of maximum, and the years of more cloud with minimum sunspot periods.

In Table II. the mean cloud extent at each 0·1 in. of pressure, and the differences from the mean for the period, are given, together with the number of days of observations from which they were determined. Finally, the whole of the mean differences duly weighted were contrasted at each point, and

TABLE II.

Height of Barometer.	1869, 1870, 1871.			1872 and 1873.			1874.			1875.			1876.			1877.			1878.		
	Mean Cloud.	Diff. from Mean of 3 Years.	No. of days of Observation.	Mean Cloud.	Diff. from Mean of 2 Years.	No. of days of Observation.	Mean Cloud.	Diff. from Mean of Year.	No. of days of Observation.	Mean Cloud.	Diff. from Mean of Year.	No. of days of Observation.	Mean Cloud.	Diff. from Mean of Year.	No. of days of Observation.	Mean Cloud.	Diff. from Mean of Year.	No. of days of Observation.	Mean Cloud.	Diff. from Mean of Year.	No. of days of Observation.
Ins.																					
29·0	8·00	+1·37	4	7·00	+0·14	4	10·00	+3·45	1	10·00	+2 68	1	9·50	+2·54	2	7·50	+0·52	2	..	..	..
·1	8·00	+1·37	6	8·50	+1·64	2	10·00	+3·45	1	..	..	..	7·67	+0·71	3	8·67	+1·69	6	7·00	—0·31	1
·2	7·45	+0·82	11	7·57	+0·71	7	8·00	+1·45	3	7·50	+0·18	4	8·22	+1·26	9	6·80	- 0·18	5	6·50	—0·81	6
·3	7·06	+0·43	16	8·23	+1·37	13	8·33	+1·78	6	8·33	+1·01	3	8·43	+1·47	7	7·44	+0·46	9	7·90	+0·59	10
·4	8·00	+1·37	31	8·47	+1·61	19	7·22	+0·67	9	7·25	—0·07	8	8·25	+1·29	8	8·12	+0·14	8	8·71	+1·40	17
·5	..	..	..	7·35	+0·49	37	8·62	+2·07	13	8·00	+0·68	11	8·12	+1·16	17	7·21	+0·23	19	7·88	+0·57	25
·6	..	..	..	8·00	+1·14	31	8·11	+1·56	18	8·46	+1·14	13	7·44	+0·48	25	7·54	+0·56	26	7·85	+0·54	20
·7	..	..	..	..	..	..	7·00	+0·45	27	8·32	+1·00	28	7·69	+0·73	29	7·35	+0·37	26	7·23	—0·08	26
·8	..	..	..	..	..	..	7·33	+0·78	30	8·97	+1·65	35	7·50	+0·54	40	7·58	+0·60	33	7·53	+0·22	34
29·9	..	..	..	..	..	..	6·67	+0·12	46	7·45	+0·13	42	7·47	+0·51	34	7·05	+0·07	44	7·53	+0·22	36
30·0	..	..	..	..	..	..	6·58	+0·03	48	6·49	—0·83	45	5·97	—0·99	37	6·98	0·00	44	7·36	+0·05	45
·1	..	..	..	..	..	..	5·24	—1·31	38	6·70	—0·62	52	6·09	—0·87	34	5·94	—1·04	36	6·37	—0·94	35
·2	..	..	..	..	..	..	5·43	—1·12	35	6·83	—0·49	35	5·66	—1·30	32	6·62	—0·36	26	5·79	—1·52	19
·3	5·90	—0·73	57	5·50	—1·36	16	5·94	—0·61	18	5·79	—1·53	24	5·26	—1·70	19	5·60	—1·38	15	7·45	+0·14	20
·4	6·00	—0·63	38	6·45	—0·41	11	5·07	—1·48	14	7·17	—0·15	12	5·64	—1·32	11	7·33	+0·35	6	7·67	+0·36	9
·5	6·12	—0·51	17	7·86	+1·00	7	6·00	—0·55	8	8·60	+1·38	5	8·50	+1·54	2	6·00	—0·98	2	7·00	—0·31	7
30·6	10·00	+3·37	2	7·00	+0·14	5	6·33	—0·22	3	..	..	..	10·00	+3·04	1	6·00	—0·98	3	6·72	—0·59	7
Means	6·63	..	..	6·86	..	..	6·55	..	..	7·32	..	..	6·96	..	..	6·98	..	..	7·31	..	..

NOTE.—No observations are entered for days on which partial fog was observed. Sundays are also omitted.

the final values so obtained are inserted in column 9 of Table I., together with the total number of observations used in their determination.

The numbers, being plotted down above and below a line, which represents the mean amount of cloud, form a curve, represented in Fig. 2, which is very similar in appearance to that given by the Sunshine-recorder.

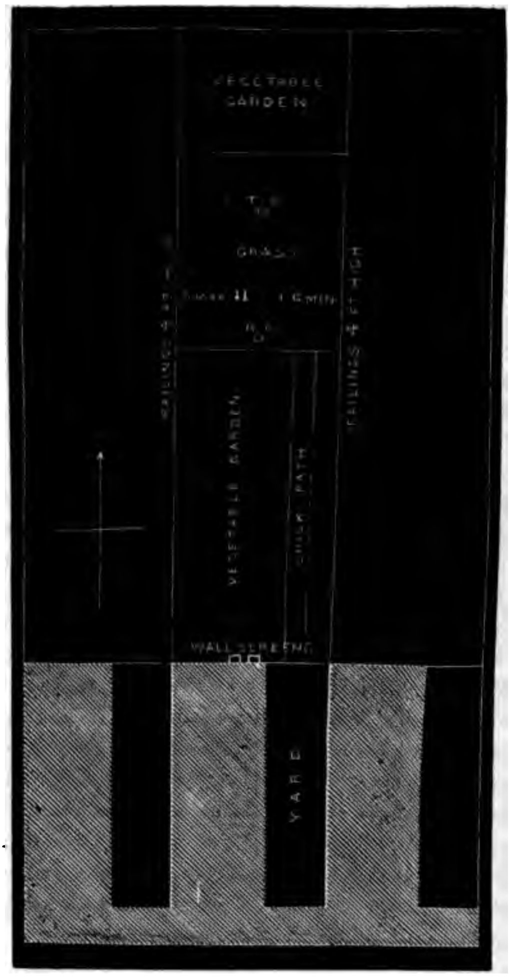
There is considerable irregularity in the curve at low barometric pressures, and a broad line has been drawn, which would probably represent more nearly the true variation in the phenomena under consideration had the present investigation been continued over a longer series of years, or had more trustworthy materials been available for the discussion. There seem, however, to be good grounds for making the following generalisations:—That the average amount of sky clouded at Kew is a little less than 7-tenths of the whole, and that the amount covered varies inversely as the barometric pressure between the limits of 29·0 and 30·3 ins., the variation being the most rapid between 29·8 and 30·1 ins. Also that above 30·3 ins. cloud increases with increasing pressure, attaining the mean about 30·5 ins., and rising above it at 30·6 ins. On comparing these generalisations with the amended weather-glass face legend, it will be seen that the latter fails to represent the real state of affairs, for there is an average number of clouds at a pressure of 30·5 ins. instead of a clear sky, and a minimum of cloud at 30·3 ins., whilst the amount is but slightly above the average at 30·0 ins., and at 29·5 ins. there is decidedly less than the mean extent of cloud. The other two points would seem to be fairly correct; so on the whole I would venture to assume as an hypothesis, that in all probability the inscription originally roughly based on fact became eventually extended to cover a longer range of scale, with a view to symmetry, than experience shows to have been desirable. Far be it from me, though, to suggest a modification of the wording, however much it may be called for, under the light of modern meteorological science; it would be just as well that it should entirely disappear, and every one learn how to interpret barometric readings in connection with gradients, isobars, Buys-Ballot's law, and other true weather guides.

XV. *Thermometer Exposure—Wall versus Stevenson Screens.* By William Marriott, F.M.S., Assistant Secretary.

[Received May 3rd.—Read June 18th, 1879.]

It being the practice of some observers to expose their thermometers on walls facing north, it seemed a suitable object of inquiry whether instruments so placed gave results comparable with those obtained from thermometers in a Stevenson stand in the open.

A pair of Meteorological Office wall screens, lent me by Mr. Scott, were fixed to the brick wall of an out-house with a northern aspect, so that the screens were in the shade except in the morning and afternoon of the summer months. The Stevenson screen is on a grass-plot 17 feet square, and is



Plan with position of Instruments. Scale: 20 feet to an inch.

about 50 feet north of the wall screen. The ground between the grass-plot and the wall is used as a vegetable garden, and the whole slopes gently towards the north, although the two stands are on about the same level. The garden is surrounded by wooden railings 4 feet high, and is open and free from obstructions, the Stevenson screen being exposed to the sun's rays throughout the year, except for a short time in December. The soil of the locality is London clay, and the height of the ground is 184 feet above sea level. One of the wall screens contained maximum and minimum, the other dry and wet bulb thermometers; the bulbs were 8 inches from the wall, and 4 feet above the ground. Observations were commenced on April 1st, 1878; and the present paper contains the results of the comparison of the mean maximum and minimum temperatures in this screen with ose in the Stevenson stand for the 12 months ending March 31st, 1879. e observations were taken at 9 a.m. and 9 p.m., with an interval of about minutes between the readings in the two stands.

The following results have been obtained :—

Months. 1878-9.	Thermometer in								Thermometer on Wall differs from that in Stevenson Stand.			
	Stevenson Stand.				Wall Screen.							
	Max.	Min.	Mean.	Range.	Max.	Min.	Mean.	Range.	Max.	Min.	Mean.	Range.
April	56°·6	40°·6	48°·6	16°·0	55°·6	40°·6	48°·1	15°·0	−1°·0	0°·0	−0°·5	−1°·0
May	63·3	47·8	55·6	15·5	63·3	48·5	55·9	14·8	0·0	+0·7	+0·3	−0·7
June	69·9	51·6	60·7	18·3	69·8	52·7	61·2	17·1	−0·1	+1·1	+0·5	−1·2
July	72·6	54·5	63·6	18·1	71·8	55·8	63·8	16·0	−0·8	+1·3	+0·2	−2·1
August ..	70·8	55·4	63·1	15·4	69·7	56·1	62·9	13·6	−1·1	+0·7	−0·2	−1·8
September	65·6	48·6	57·1	17·0	63·5	49·3	56·4	14·2	−2·1	+0·7	−0·7	−2·8
October ..	58·6	44·9	51·7	13·7	56·7	45·2	50·9	11·5	−1·9	+0·3	−0·8	−2·2
November	43·7	35·2	39·5	8·5	43·1	35·1	39·1	8·0	−0·6	−0·1	−0·4	−0·5
December	37·1	29·3	33·2	7·8	36·6	29·4	33·0	7·2	−0·5	+0·1	−0·2	−0·6
January ..	35·0	28·5	31·8	6·5	34·5	28·5	31·5	6·0	−0·5	0·0	−0·3	−0·5
February	42·7	34·2	38·4	8·5	41·5	34·6	38·0	6·9	−1·2	+0·4	−0·4	−1·6
March ..	48·8	35·0	41·9	13·8	47·0	35·4	41·2	11·6	−1·8	+0·4	−0·7	−2·2
Means ..	..	..	..	..	..	..	..	..	−1·0	+0·5	−0·3	−1·4

These figures show that the mean daily maximum temperature on the ll is below that in the open, the monthly differences varying from ·0 to — 2°·1, that for the 12 months being — 1°·0. The mean minimum mperature on the wall was mostly higher than in the Stevenson stand, the fferences varying from — 0°·1 to + 1°·3, the mean for the year being 0°·5. The individual differences, however, are sometimes much greater, e maximum temperature on the wall being considerably lower than that in e stand. For instance, the difference exceeded 4°·0 five times in September, and four times in March, the greatest being 6°·7 ; these extremes curred on fine calm days. The minimum temperature on the wall was ore than 2°·0 higher than that in the Stevenson stand on five occasions in ne, seven in July, and four in September. The mean daily range of temrature on the wall for the 12 months was 1°·4 less than in the stand in the en. The greatest difference was on March 9th, when the range on the ll was 8°·5 less than in the stand.

These results seem to show that, although the mean temperature may be ughly ascertained from thermometers shaded by a wall with a northern pect, this method of exposure affords less sensitive indications than those tained from instruments in a properly exposed Stevenson stand.

DISCUSSION.

Mr. SCOTT said that the wall screen was a small box, 1 ft. 5 ins. high, 8¼ ins. wide, and 5½ ins. deep, with single louvres on three sides and the bottom, and a plain board at the top and back. It was the screen used on board ships supplied with instruments by the Meteorological Office. The screen used for maximum and minimum instruments was of similar size, but with its greatest length horizontal. A series of comparisons was at present being made at Kew between the temperatures in the Stevenson and Wild screens, the latter being that used in Russia.

Mr. SYMONS believed that the air inside a Stevenson screen was warmer than outside, as the top of the screen got heated up by the sun, and so influenced the readings of the thermometers. Numbers of comparisons had been made at Strathfield Turgiss between the different forms of screens, but the results had not yet been published. A comparison of the results obtained from his Stevenson screen and a Glaisher stand, at Camden Square, showed that in summer the range of temperature on the Glaisher stand was much the greater, the average maximum being about 1°·2 higher, and the minimum about 0°·8 lower; the closeness of the Stevenson screen had the practical result of making the indication of the thermometers sluggish, so that the true maximum and minimum were not registered unless the temperature remained steady in the screen for a considerable time. In winter, the range on the two stands was nearly equal, but the mean maximum and minimum were each about 0°·5 lower on the Glaisher stand, probably owing to those thermometers being able to radiate to the sky.

Mr. LAUGHTON thought that the figures in Mr. Marriott's table bore out Mr. Symons's suggestion that some part, at least, of the difference might be due to the Stevenson screen being unduly heated by the sun. During the cold months of winter the agreement between the two sets of observations was very close.

Dr. TRIPE said that he had lately made some comparisons between thermometers placed in a small screen resembling Stevenson's, fixed 5 ins. above the top of a wall, and a thermometer fastened to a wall, but kept 1 in. from it, having a northern aspect and a roof of ivy above. The wall on which the supports of the screen were placed was also covered with ivy. These comparisons were not quite satisfactory, as the maximum thermometer read much too high on hot sunny days when there was but little wind. He, therefore, had had the louvred back removed, and a double wooden back put in its place, the space between the boards being 1 in. He had holes cut 1½ in. square in the inner piece of wood, corresponding with the bulbs of the thermometers, when he obtained much greater uniformity of readings from the thermometers placed in the screen and on the wall. His Stevenson screen was double louvred.

Mr. MARRIOTT said that the dry and wet bulb observations extended only from April to October, but the results, as given in the Table on the next page, showed that in the Wall screen at 9 a.m. the dry bulb was 0°·4 lower, the wet bulb 0°·4 higher, the difference 0°·7 less, the dew point 1°·1 higher, and the humidity 4 per cent. greater than in the Stevenson screen. At 9 p.m. in the Wall screen the dry bulb was 0°·3, and the wet bulb 0°·5 higher, the difference 0°·1 less, the dew point 0°·6 higher, and the humidity 1 per cent. greater than in the Stevenson.

WALL *versus* STEVENSON SCREENS.

Months.	In Stevenson Screen.					In Wall Screen.					Wall differs from Stevenson.				
	Thermometer.		Difference.	Dew Point.	Humidity.	Thermometer.		Difference.	Dew Point.	Humidity.	Thermometer.		Difference.	Dew Point.	Humidity.
	Dry.	Wet.				Dry.	Wet.				Dry.	Wet.			
9 a.m.	°	°	°	°	o/o	°	°	°	°	o/o	°	°	°	°	o/o
April ……	48·7	45·9	2·8	42·8	81	48·1	45·9	2·2	43·5	84	—0·6	0·0	—0·6	+0·7	+3
May ……	56·0	52·0	4·0	48·2	75	56·3	53·2	3·1	50·3	80	+0·3	+1·2	—0·9	+2·1	+5
June ……	62·8	56·9	5·9	51·8	69	63·1	57·8	5·3	53·2	71	+0·3	+0·9	—0·6	+1·4	+2
July ……	64·2	59·1	5·1	54·8	72	64·4	59·8	4·6	56·0	74	+0·2	+0·7	—0·5	+1·2	+2
August ….	63·4	59·5	3·9	56·1	78	63·1	59·8	3·3	56·9	80	—0·3	+0·3	—0·6	+0·8	+2
September	57·5	54·1	3·4	51·0	79	56·3	54·0	2·3	51·9	87	—1·2	—0·1	—1·1	+0·9	+8
October ….	51·8	49·4	2·4	47·0	84	50·6	49·1	1·5	47·5	90	—1·2	—0·3	—0·9	+0·5	+6
Mean ….	..	..	..	..	..	..	..	..	..	..	—0·4	+0·4	—0·7	+1·1	+4
9 p.m.	°	°	°	°	o/o	°	°	°	°	o/o	°	°	°	°	o/o
April ……	46·4	44·5	1·9	42·4	87	46·5	44·7	1·8	42·7	87	+0·1	+0·2	—0·1	+0·3	0
May ……	52·5	50·3	2·2	48·1	85	53·0	51·1	1·9	49·2	87	+0·5	+0·8	—0·3	+1·1	+2
June ……	58·3	55·1	3·2	52·2	80	58·8	55·8	3·0	53·1	82	+0·5	+0·7	—0·2	+0·9	+2
July ……	61·1	57·8	3·3	54·9	80	62·1	58·5	3·6	55·4	79	+1·0	+0·7	+0·3	+0·5	—1
August ….	60·2	57·8	2·4	55·7	86	60·6	58·2	2·4	56·1	85	+0·4	+0·4	0·0	+0·4	—1
September	54·7	52·9	1·8	51·1	88	54·7	53·1	1·6	51·5	90	0·0	+0·2	—0·2	+0·4	+2
October ….	49·9	47·9	2·0	45·8	87	49·8	48·1	1·7	46·3	88	—0·1	+0·2	—0·3	+0·5	+1
Mean ….	..	..	..	..	..	..	..	..	..	..	+0·3	+0·5	—0·1	+0·6	+1

XVI. *Report on the Storm of the 20th and 21st of March,* 1879, *as experienced at the Royal Alfred Observatory of Mauritius.* By CHARLES MELDRUM, M.A., LL.D., F.R.S., F.M.S.

[Communicated by the Right Honourable Sir MICHAEL HICKS BEACH, Bart., Secretary of State for the Colonies.]

[Received May 10th.—Read June 18th, 1879.]

FROM the 1st to the 19th of March the SE Trade wind prevailed in light to fresh breezes, with fine weather for the season, the total rainfall having been only 1·05 in. against an average of 5·10 ins. for the last 9 years.

The mean daily height of the barometer, corrected and reduced to sea level, ranged from 30·084 ins. to 29·926 ins., and the temperature of the air from 84°·4 to 66°·0. Although the weather was somewhat squally and unsettled on the 17th and 18th, as is often the case near the Equinox, yet there was nothing alarming in it till the evening of the 19th. At 5 p.m. on the 19th, the barometer being 29·918 ins., and the wind from ESE at the rate of 25 miles an hour, a telegram was sent to the Harbour Master. The question to be decided was whether the wind would increase before daylight; and after watching the barometer, anemometer and weather till 9 p.m., it was concluded that there was nothing to fear before next morning at least. A few minutes after sunset on the 19th the upper cirrus clouds assumed at first a yellowish ash colour, which deepened into scarlet, and then changed into dark red. At one time the whole sky looked as if it were on fire. This was an indication of a coming storm. The barometer fell slowly during the night of the 19th and on the morning of the 20th, but the wind decreased, and it did not attain a velocity of 25 miles an hour till 5 a.m. on the 20th. By 9 a.m. on the 20th the barometer had fallen to 29·811 ins., and the wind, which was from SE by E, had a velocity of 30 miles an hour. It being now evident that a cyclone was approaching, a telegram was sent to Port Louis, and thence to all the railway stations, &c., announcing the danger, and expressing the opinion that precautions should be taken. Another telegram was despatched at noon, and from that time till 10 p.m. two-hourly telegrams were sent, announcing the progress of the storm. From 9 a.m. till 8 p.m. the wind was pretty constant from SE, and it was impossible to say with certainty whether the centre would pass North or East of Mauritius, or over it; but it was evident that the gale would increase as the night advanced. Towards 9 p.m. the wind, although oscillating a good deal, showed a considerable tendency to veer towards the E, and by 10 p.m. it was manifest that the centre would pass N and NW of Mauritius. The wind reached E about 2.20 a.m., and NE at 8 a.m. on the 21st. From the latter hour till 5 p.m. on the 22nd it remained almost steady at NE, occasionally passing in the squalls to NNE, beyond which it did not go. It then gradually backed to E by N, attaining that point at 5 p.m. on the 24th. On the whole, the mean hourly velocity of the wind increased from 55 miles at 4 p.m. on the 20th to 80·5 miles between 5.30 and 6.30 a.m. on the 21st.

In the squalls it was greater, from 1.52 to 2.07 a.m., for instance, and again, from 6.13 to 6.28 a.m. its hourly rate was 100 miles. After 6.30 a.m. the wind began to abate, and by noon its velocity was 55 miles an hour, and 39 miles at midnight. The lowest barometric pressure (corrected and reduced) was 29·032 ins. at 2.15 a.m. on the 21st. It then began to rise slowly, reaching 29·168 ins. at 6 a.m., and 29·499 ins. at noon. By 9 a.m. on the 22nd it was 29·889 ins. From 1 p.m. on the 20th to 6 p.m. on the 22nd the mercury oscillated; and very considerably so from 8 p.m. on the 20th to 7 a.m. on the 21st. The sky was overcast by nimbus and cumulo-stratus from 6 a.m. on the 20th to 9 a.m. on the 22nd; and the total rainfall from 9 a.m. on the 20th to 9 a.m. on the 22nd was 9·15 ins., of which 7·45 ins. fell during the first 24 hours. No thunder or lightning was observed. This has been the severest cyclone that has visited the island since March 1874. On that occasion the bad weather lasted five days; fortunately, on the present, its duration was much less. If the wind had maintained for some hours longer the velocity it had from 1 to 7 a.m., the damage would have been much greater.

A copy of the telegrams is given in the Appendix.

APPENDIX.

STORM WARNINGS.

The following telegrams were despatched by the Observatory on Wednesday, the 19th March:—

(1.) *To Telegraph Superintendent.* 5 p.m.

As the weather is unsettled, please keep the telegraph offices *open till 7 o'clock.*

(2.) *To Harbour Master.* 5 p.m.

The reading of the barometer is 29·868 ins., and, corrected and reduced, it is 29·918 ins. The wind is ESE 25 miles an hour, and will probably increase.

I have requested that the telegraph offices be kept open till 7 p.m. If by that time the barometer do not rise, a gale may be expected towards morning.

(3.) *To Harbour Master.* 7 p.m.

Since 5 p.m. the barometer has risen ·021 in., which is nearly its normal variation. The wind is from ESE to SE by E 20 miles an hour.

As the barometer is rising and still high, there is, in my opinion, no fear before to-morrow at least. Will telegraph at 9.

(4.) *To Harbour Master.* 9 p.m.

Since 7 p.m. the barometer has risen ·011 in. The total rise since 5 p.m. has been ·032 in., but the normal rise is ·059 in. Therefore, the barometer has, on the whole, been falling. The wind is from SE by E at the rate of 20 miles an hour. Though the barometer is falling a little, it is still so high, and the wind so moderate, that it may be safely said there is no fear before to-morrow at least.

It is estimated that if the wind increase, its velocity cannot exceed that of what sailors call a "strong breeze" before 6 a.m.

The following telegrams were sent to the Central Telegraph Office on Thursday, the 20th instant:—

(1) Observatory, 9 a.m.

Barometer reading 29·760 ins., and corrected and reduced 29·811 ins. Falling at accelerated rate. Wind SE by E.—30 miles an hour.

A cyclone to the NE and approaching the island. As yet it is impossible to say whether the centre will pass N or E of Mauritius, or over it, but there is little doubt that between this and to-morrow the wind will increase to a strong gale, and in my opinion precautions are necessary.

Please send copies of this telegram to the Harbour Master, Reduit, &c., and to all the Railway Stations, where they should be posted up. It is not probable that the force of the wind during the day will be such as to prevent traffic. Will telegraph at noon.

(2) Noon.

Barometer corrected and reduced 29·718 ins. and falling at the rate of ·033 in. per hour. Wind SE by E, 36 miles per hour, and increasing.

The only chance of escape is that the wind will veer or back, and as yet there is no sign of this. Everything indicates the approach of a storm.

Please send copies and post up at stations. Will telegraph at 2 p.m.

(3) 2 p.m.

Barometer 29·605 ins., and falling at the rate of ·039 in. per hour. Wind SE by E, 44 miles per hour. Indications unfavourable, except that occasionally the wind shows a slight tendency to back towards the S. All that can be done is to prepare for the worst. The wind may abate in the evening, but it will increase during the night.

Please send copies and post up. Will telegraph at 4 p.m., if possible.

(4) 4 p.m.

Barometer 29·488 ins., and falling at the rate of ·055 in. an hour. Wind SE 56 miles.

It is estimated that the centre of the cyclone bears NE 180 miles. There is a slightly increasing tendency in the wind to back. If this continues the danger will decrease. Will telegraph at 6 p.m.

(5) 6 p.m.

Barometer 29·440 ins., and falling at the rate of ·034 in. per hour. The wind has not maintained the tendency it had to back. It is oscillating between ESE and SE, and its mean velocity is 60 miles.

Conditions unfavourable. The wind will increase. Will telegraph at 8 p.m.

(6) 8 p.m.

Barometer 29·873 ins., and falling at the rate of ·050 in. per hour. Wind SE by E ½ E 60 miles.

The wind is almost steady from the same quarter, which shows that the centre is still approaching, and that the velocity of the wind, which during the last two hours has been pretty constant, will increase as the night advances.

Please keep office open till 9.

(7) 9 p.m.

Barometer 29·824 ins., and falling at the rate of ·063 in. Mean direction of wind ESE, at the rate of 66 miles.

The wind has a rather decided tendency to veer towards E, and it is not improbable that the centre of the storm will pass N of the island. If it should do so we shall have, after 11 p.m., an increasing wind, the maximum velocity of which will probably be attained between 4 and 7 a.m., with the wind from E. It is estimated that this maximum will not be less than 80 miles an hour. If, which is not so likely, the wind back to S, its force will be less.

Being anxious to be able to telegraph a decided change of wind, will you kindly keep the office open till 10?

(8) 10 p.m.

Barometer 29·282 ins., and falling at the rate of ·049 in. per hour. Mean direction of wind ESE ½ E, and velocity 65 miles.

The wind shows a decided tendency to veer towards E, and it is estimated that it will reach that point about 2 a.m. with increased velocity; after 11 p.m. the barometer will fall at an accelerated rate, and the wind increase till it has reached ENE. It is possible, but not probable, that the centre of the storm will pass nearer to us than is now supposed, which is about 50 miles.

Unnecessary to send more telegrams to-night.

During a considerable part of the 21st, telegraphic communication was interrupted, but the following telegram was despatched at 1 p.m.:—

21st March, 1 p.m.

The greatest mean hourly velocity of the wind was 80·5 miles from ENE, between 5.30 and 6.30 this morning, but in some of the squalls the velocity was greater.

The lowest barometer was 29·037 ins. at 2 a.m. with the wind from E ½ S. Immediately the wind passed to the North of E, the barometer rose, and it has continued to do so.

At present (1 p.m.) barometer 29·526 ins., wind NE ½ N 48 miles, and weather gradually improving.

The storm is pursuing its course to the SW, and probably Reunion is suffering from it.

C. MELDRUM.

XVII. *On the Meteorology of Mozufferpore, Tirhoot, during the Year* 1878. By CHARLES N. PEARSON, F.M.S.

[Received March 7th.—Read June 18th, 1879.]

THE year began with 10 days of bitterly cold weather, during which the temperature on 8 consecutive nights fell to below 40°. Frost on the ground occurred on several nights. The lowest temperature, 35°, occurred on the 7th of January. On the 10th the weather changed, and the rest of the month was seasonable. Showers fell on the 11th and 13th, and 1·24 in. of rain on the 27th; hence the winter crops promised favourably, though the frost at the beginning of the month did some damage.

In February the temperature was generally above the average; the mean was 9° higher than that of February 1877. March was seasonable; the first week was cool, but great heat prevailed after the 24th, the thermometer on the 29th reaching 98°, with strong W winds. April was a pleasant month on the whole, cool in the middle, and unsettled, with storms in places, after the 12th. There was a smart hailstorm on the 15th, in which some of the stones were about the size of marbles. May was unusually cool, with frequent storms. The rainfall was large; 4·75 ins. fell here, but in many places as much as 7 ins. fell during the month. On the 23rd two storms of great severity occurred, with 1·51 in. of rain. Hail fell during the storms of the 10th and 27th; the weather was extremely unsettled till the 29th, when steady hot weather set in. June was intensely hot till the 24th. From the 5th to the 21st the maximum day temperature exceeded 100°, and on the 14th and 15th it attained 106° and 107° respectively. The night temperature was also very high; the minimum exceeding 80° on every night from the 5th to the 25th. The lowest temperature on the night between the 14th and 15th was 86°, which, after the oppressive heat of the day, and with no breeze, made the heat almost unbearable. Generally, however, a strong easterly breeze blew by day and night. During this interval of 24 days no rain fell, and everything was much parched, notwithstanding the abundant rains of May. The rains set in on the morning of the 25th, and showers fell daily till the 29th. On the evening of the 30th a large flight of locusts came up from the SE and settled on many parts of the station, though without doing much damage, except stripping the tops of the Cassiorina trees in the compound. They also settled on an Indigo field and devoured the young plants, which, however, fortunately recovered with the rains then just setting in. The mean temperature of June was 90°·1, which exceeded that of June 1877, also a very hot month, by 2°·5.

July was seasonable; rain fell throughout the month. The weather was very warm, damp and oppressive, the mean temperature being 86°·4. August and September were seasonable. The rains were lighter than usual, and the fall, though rather below the average, was larger and more equally distributed than in 1877. The humidity was also greater, hence the rice crops promised well. On the 22nd of September a slight cyclone was felt in Eastern Bengal, advancing in a northerly direction till it manifested itself at Purneah on the 24th. The weather here was extremely oppressive from the 18th to the 21st of September, and from the 22nd to the 25th it was evident that a cyclonic disturbance was existing at no great distance. Contrary currents of air prevailed, and great banks of clouds accumulated to the E and SE. Nothing further was, however, perceptible; but on the 25th and 26th a considerable fall of rain occurred. The fair prospects of the rice crops rather fell off in October. A slight shower fell on the 2nd, and a severe squall from the N, with 0·28 in. of rain, was experienced on the 6th; with this exception, the month was dry and hot. Unusual heat prevailed in the first week.

November began with warm weather. The 7th was overcast with drizzling rain, 0·30 in. In some parts of the SE of the district there was a large fall of rain on this day. With great changes of temperature, heat, on the whole, prevailed. For some days before the 7th clouds were gradually advancing from the SE, and this place was evidently on the extreme NW limit of the area of rainfall, as in Chumparun, 50 miles NW of this, no rain fell. It, however, increased towards the SE. A cyclone raged on the Madras Coast on the 5th and 6th, and this rain was probably caused by that atmospheric disturbance.

The first 10 days of December were warm for the season; but the cold weather set in on the 10th, and from the 20th to the 30th it was unusually cold, the thermometer falling to 37° on the 23rd and 28th. No rain was recorded. On the 30th another swarm of locusts appeared, smaller than that of the 30th of June; the locusts passed over without doing any damage.

The total fall of rain in 1878 was 36·20 ins., being 7·20 ins. more than in 1877, but still much below the average. The rice harvest on the lowlands was generally good; but in consequence of the failure of the usual October rains, much rice on the high lands was a failure.*

XVIII. *Meteorological Observations on the Peak of Teneriffe.* By WILLIAM MARCET, M.D., F.R.S., F.M.S.

[Received June 12th.—Read June 18th, 1879.]

THE Island of Teneriffe affords much interest in a meteorological point of view. Its position in N lat. 28° 20′, and at 115 English miles from the nearest African coast, with the high winter temperature of the sea around it, give the summer and winter of Teneriffe a uniform character. Although about the end of summer the clouds disperse, and the heat of the sun becomes oppressive, still the NE Trade wind and its zone of mist check any excessive rise of temperature during most of the year.

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* This Paper was accompanied by Tables of Daily Observations of the Thermometers, Barometer, Cloud, Rain, Wind and Weather, which have been deposited in the Library.

If such be the climate below the clouds, it is entirely reversed above them. The Trade wind clouds hovering round the lofty Peak act much like a blanket, effectually retaining below the heat absorbed by the earth during the day, and preventing that given out at the surface of the sea from radiating into space. On the Peak, above the clouds, the solar heat is felt most powerfully, while the radiation from the volcanic material of which the mountain consists, and probably to some extent from the upper surface of the fog bank, causes a considerable fall of the temperature after sunset. It follows that, while the mean atmospheric day and night temperature at the seaside in summer varies only by 7° or 9°, the corresponding difference above the cloud stratum amounts to about 40°.

On my return from the Canary Islands I ascertained the temperature of the surface of the sea to be 73°·8 on the 4th August, 1878, at Santa Cruz, Teneriffe, in lat. 28° 30′; 71°·8 off Mazagan, Morocco coast, lat. 31° 40′; 70° off Casa Blanca, and 63°·8 off the coast on nearing Tangiers; giving a difference of 10° for the temperature of the surface of the sea, not far from the African coast, between the latitude of Tangiers and that of Teneriffe. The enormous amount of vapour arising from this warm sea water forms into a bank of cloud, which hovers over the sea, and is wafted southwards by the NE Trades, where part of it undergoes condensation along the coast of Guinea. The cloud stratum on its upper surface is constantly wasting away, while fed below by evaporation from the sea; so that the zone of cloud is always moving upwards, although not changing either in thickness or shape. The moisture transformed into invisible vapour in the dry air above the cloud bank is finally carried northward by the return SW anti-trade wind, to fertilise Europe, clear the air and soil of impurities in its populous districts, and feed the mountain glaciers. The only power in all this huge circulation of water is the heat of the sun.

I landed at Santa Cruz, Teneriffe, on the 25th of June, 1878, and proceeded next day over the north-eastern promontory of the Island to Puerto de Orotava, a small sea-side town at the foot of the Peak. Although my object was mainly physiological, I had taken with me thermometers and a Fortin barometer, all by Casella, and hoped to make a few observations as to temperature, atmospheric humidity, and barometric pressure.

In 1856 Mr. Piazzi Smyth, Astronomer Royal for Scotland, spent a considerable time on the Peak, and his paper* gives a very interesting and complete record of observations as to temperature, atmospheric humidity, barometer readings, &c., taken during part of July, August and part of September. I had proposed to keep a meteorological journal, and succeeded, more or less, during my stay at my first station on the Peak; but I subsequently found it very difficult to make regular observations, and had to be contented with preserving occasional records of meteorological phenomena.

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* "Astronomical Experiments on the Peak of Teneriffe, carried out under the sanction of the Lords Commissioners of the Admiralty."—'Philosophical Transactions,' 1858, Part II., p. 465.

On Wednesday, the 26th of June, at 7 a.m., four mules were standing at the door of Mr. Turnbull's Fonda Englesa at Puerto de Orotava, and the work of packing was commenced. My baggage was considerable, as it included provisions in tins to last me and my companion, a Chamounix guide, for about three weeks. A fifth mule was pressed into service, and a horse came round with its driver, in case I should wish to ride.

As we proceeded up the steep street leading out of the town towards the Peak, the procession excited some interest among the inhabitants, as the Peak is but seldom ascended.

We first of all passed two round hills, standing out like huge tumuli, and putting one somewhat in mind of Monte Nuovo, though higher. One of these mounds rose about 1,000 feet above the sea, and might have measured 600 or 700 feet from base to summit; the other was smaller. The air at the time was still, clear out at sea, cloudy overhead.

We entered the fog-stratum floating round the Peak at 1 p.m., and 3,200 feet above the sea, the fog then driving from the E. A call for a halt for dinner at 2 p.m., while full in the fog, was cheerfully responded to; the mules were unloaded and the whole party dispersed amongst the ferns. After leaving at 2.30 p.m., a decided increase of temperature was noticed, at an altitude of 3,200 feet, although the mist was as thick as ever; the breeze was then blowing N by W. Soon, however, the mist became thinner and the sun's light brighter, and at 5,500 feet high we emerged from the fog into the clear atmosphere, with a dark, spotless blue sky above.

Before being fairly out of the fog, light pencils of mist drifted up from the NE at the rate of between 5 and 10 miles an hour, and again vanished away. I stood watching the transformation ever in progress at the upper surface of the Trade wind clouds; the mist was rising from below and rapidly dissolving to float up in the form of invisible vapour into the SW return current. The thickness of the cloud stratum (by aneroid measurement) amounted, therefore, at the time to 2,300 feet, the whole mass moving upwards at the rate of between 5 and 10 miles an hour, although never reaching higher above the sea.

When quite out of the fog the breeze was E by N; we emerged into warm weather, and the stones were hot enough to be unpleasant to stand upon for more than an instant. The majestic Peak of Teneriffe rose to our right, its beautiful lines showing distinctly against the blue sky; and after we had risen a little higher, looking backwards, we appeared to have emerged from a mass of vapoury foam. We entered the circular belt round the Peak about 5 p.m., and rode along a flat volcanic sandy course, with the circle of high rocks limiting the Old Crater, and known as the Canadas, on our left. Night came on, and we were still on our way towards the foot of Mount Guajara, the highest of the Canadas. At 8 o'clock, after climbing a rocky slope on our left in complete darkness, the guide proclaimed that we had arrived.

The next morning we pitched our tent on a sandy track between Mount

Guajara and the plateau of lava extending to the foot of the actual Peak, at an altitude of 7,090 feet. The men and mules, one of them excepted, returned to Puerto with empty bags, and I was left alone with my guide and the Spanish driver with his mule.

We soon put up a wooden shed, consisting of light deal boards, and which had been constructed in pieces in London, to serve as a protection against the rays of the sun. The boards were supported on four poles, secured by tent ropes and pegs. Strips of canvas nailed to the shed on two opposite sides, also fastened by strings and pegs, added to the sheltered area. My dry and wet bulb thermometers were placed in a box used as a screen, and perforated by a large number of holes of a sufficient size to allow of free access of air to the instruments. The screen was fixed to one of the shed poles, and sheltered by the wooden roof from the direct rays of the sun. The barometer was also secured to another of the shed poles.

The leading feature of the meteorology of that zone which extends above the cloud stratum on the Peak of Teneriffe is the intense heat in the day and extreme cold at night, added to a very great degree of dryness of the atmosphere, especially in the daytime. The sand and lava become intolerably hot in the afternoon, so that the hand cannot bear being in contact with them for more than a second or two; this is the more remarkable, because of the terrestrial radiation, which must be considerable.

As to the cold felt at night, on the 3rd of July, at 5 a.m., that is before sunrise, I placed a thermometer on the sand, and found it to register 24°·8. A soup plate half full of water, placed on the sand the previous evening, was found to contain a solid block of ice, although water left in bottles under the shed had escaped freezing; the morning before, however, the Chamounix guide had found the water in those bottles frozen. On the 1st of July the thermometer on the sand at 4.5 a.m. registered 28°, and under the screen 35°. On the 4th of July the temperature on the sand at 5.15 a.m. was 26°·5, and under the screen 36°·7. The cold was less on the morning of the 5th of July, and the thermometer registered at 4.35 a.m., 32° on the sand, and 47°·5 under the screen. The early morning of the 6th was the coldest I experienced, yet at noon that was the hottest day. The temperature on the sand was, on that occasion, 23° before sunrise, and 83° under the screen at noon. Assuming the temperature to have been 30° under the screen before sunrise, this would give a range of 53° during the period which elapsed between shortly before sunrise and noon. The air then felt oppressively hot. At 3.30 p.m. a small white cloud was visible about due north, quite a phenomenon in the spotless sky; it looked like a huge balloon in mid-air some distance from the Peak; in the course of a few minutes it had vanished. There was much haze in the atmosphere on that day, which became clearly visible in the rays of the setting sun. The night following was again very cold.

On the 9th of July the haze or atmospheric dust was again observed. Mr. Piazzi Smyth, in his paper, alludes to this phenomenon; in the present instance this dust, apparently of a silicious nature, proved inconvenient, settling on my balance inside the tent, and making it necessary to wipe frequently the knife edges at the point of suspension of the beam while using the instrument. On that day a change took place in the temperature of the air before sunrise; it no longer had the sharp cold feeling of the preceding mornings, and there was a pretty display of light cirrus clouds overhead. I visited Mr. Smyth's astronomical station on the summit of Mount Guajara, 1,800 feet above my camp; the walls built 22 years before, of stones, were still in a fair state of preservation, but the structure was roofless.

The next point of meteorological interest connected with my stay at the Guajara Station was the low degree of atmospheric Humidity. An idea of the dryness of the air will be gathered from the following figures:—28th of June, at 6 a.m., or after sunrise, difference between the dry and wet bulb thermometers, 16°·7; 12.10 p.m., 23°·8; 7 p.m. 24°·8: 29th of June, difference of readings at 6.30 a.m., 18°; at noon, 23°·8; at 6 p.m. 22°·2: 1st of July, 6 a.m., 12°·5; but at 6 p.m. the wet bulb was 29°·5 below the dry. On the 2nd of July the difference at 6 a.m. was 29°; at noon, 30°·5; at 6 p.m. 23°·5. On the 6th of July, which was the coldest day before sunrise and the hottest at noon, at 6 a.m. dry bulb was 69°, and wet 46°·8, difference 22°·2; at noon, dry bulb 83°, wet 53°·5; difference 29°·5; at 6 p.m. dry bulb 78°, wet 55°·2, depression of the wet below the dry bulb 22°·8.

On July 7th the atmospheric moisture had increased, light cirrus clouds were visible above my station, and the difference between the two thermometers was 9° at 6 a.m.; at 1 p.m. 28°; the air was then very hot.

The observations at Guajara of temperature and atmospheric humidity are appended in the following table:—

Readings of Dry and Wet Bulb Thermometers at Guajara, 7,090 feet above sea, clear sky above, clouds below.

Time.		Dry Bulb.	Wet Bulb.	Difference.
	Hour.	°	°	°
June 28.	6 a.m.	64·7	48·0	16·7
	12.10 p.m. ..	75·5	49·2	26·3
	6.10 p.m. ..	71·0	..	..
	7.0 ,, ..	67·8	43·0	24·8
29.	6.33 a.m. ..	53·8	35·8	18·0
	Noon	74·0	50·2	23·8
	6 p.m.	65·0	42·8	22·2
30.	6.5 a.m.....	46·0	..	..
	8.17 ,, ...	65·5	45·8	19·7
	12·20 p.m. ..	74·0	47·5	26·5
	6 p.m.	65·5	41·8	23·7
July 1.	4.50 a.m. ..	35·0	..	..
	6 a.m.	45·0	32·5	12·5
	Noon	44·0	..	..
	6 p.m.	69·0	39·5	29·5
2.	6 a.m.	61·0	32·0	29·0
July 2.	Noon	72·0	41·5	30·5
	6 p.m.	65·5	42·0	23·5
3.	Noon	75·0	51·8	23·2
	6 p.m.	65·0	43·0	22·0
4.	Noon	73·5	47·5	26·0
5.	4·35 a.m. ..	47·5	37·0	10·5
	Noon	75·6	51·0	24·6
6.	6 a.m.	69·0	46·8	22·2
	Noon	83·0	53·5	29·5
	6 p.m.	78·0	55·2	22·8
7.	5 a.m.	45·5	36·5	9·0
	6 ,, ...	50·0	38·5	11·5
	1 p.m.	81·0	53·0	28·0
			Mean	22·2

The cold *felt* at night greatly exceeded that which would have corresponded to the temperature of the air had it been saturated with moisture. The human body, being damp both at the surface of the skin and in the lungs and air passages, may, to a certain extent, be regarded in the light of a wet-bulb thermometer. I have taken much pains in my Teneriffe experiments to determine accurately the amount of water evaporated in the daytime from the lungs and air tubes, and to obtain a knowledge of the amount of heat actually withdrawn by the process. The mean of 22 experiments made in the daytime at the Guajara Station yielded an evaporation of 247 milligrammes, or 3·8 grains, of water per minute from the lungs and air passages. If every grain of water evaporated carried off with it sufficient heat to raise 960 grains of water 1° F., then 3·8 grains of water would carry away with it sufficient heat to raise 3,648 grains, or rather more than ½ lb. of water 1° per minute. On the other hand, while at the seaside on the Island of Teneriffe, under, of course, a high barometric pressure, and in an atmosphere much damper than above the clouds on the Peak, the elimination of 183 milligrammes, or 2·8 grains only, of water per minute from the lungs was registered, corresponding to a loss of heat of these organs capable of raising only 2,688 grains, or 1,000 grains less of water 1° F. per minute. In the daytime the heat thus robbed from the inside of the chest was balanced by the heat of the air breathed, but at night no such return of heat could take place. There was, indeed, at that time a double source of loss of heat from the body: first of all, evaporation from the lungs and skin; and next, the cold air inspired, which was expired warm.

It may be added that the rapidity of circulation of the blood and the formation of carbonic acid at night are normally below their standard in the daytime, so that every circumstance combined to lower the temperature of the body at night. Of course bed coverings could not check the loss of heat by evaporation from inside the chest; a metallic respirator would have been much more to the purpose. Two flannel shirts, flannel drawers, three blankets, one thick plaid and a covering of India-rubber cloth over all, were insufficient to produce in my case a comfortable degree of warmth.

The meteorological influences of the atmosphere above the clouds on the chemical changes of respiration were sharply defined; while in the Alps an increase in the carbonic acid expired took place at increasing altitudes, which I attributed to the influence of cold, on Teneriffe, where the temperature was invariably high in the daytime, I barely noticed more than a slight tendency to an increased formation of carbonic acid, and at the highest station, over that expired at the seaside. This was the case with me; while in that of the guide there was a considerable excess expired at the seaside. This result was probably due to the guide perspiring more readily than I did, and, consequently, losing more heat through that function in the light air of the Peak than occurred in my case. The high pressure at the seaside, by checking his perspiration, probably, on the other hand, predisposed his body to be more readily affected by heat. It was, moreover, very remarkable that I expired considerably more carbonic acid within a given time on the Island of Teneriffe than in the Alps. His being, also, accustomed to live among mountains under low barometric pressure, would naturally predispose him to emit less carbonic acid than I should, high up on the Peak of Teneriffe.

The influence of the dryness of the atmosphere above the clouds, of a physical nature, was very interesting to observe. I noticed, as Mr. Piazzi Smyth had done in 1856, that deal boxes readily cracked and split; then, while writing under a tent, there was no need of blotting paper, the ink drying up in writing one word before the next was commenced. Fresh meat became dry and horny in four or five days, and appeared as if it would never show any signs of decomposition. This was especially the case at the Guajara Station, as at Alta Vista, although a higher place, but with a slightly damper air, meat began to decompose after a few days. The leathers of our boots cracked and the soles gave way as if they had been burnt, so that after our three weeks' stay on the Peak they were in a very dilapidated state. The skin of our hands showed signs of peeling off, while white lines appeared round the cutaneous pores. The surface of the skin became so brittle from its dryness that the rough contact with any sharp stony edge, such as that of masses of lava, caused a scratch which proved most troublesome to heal.

The most remarkable effect of the physical action of the dry air on the Peak of Teneriffe is the great readiness with which bodies under its influence become electrified. On slipping into bed I was at first greatly surprised at a luminous flash appearing under the bedclothes. This led me to rub the sheets and pillow case with the hand, when bright white streaks were produced. I showed this to the guide, and we amused ourselves with trying how we could obtain the brightest light. Friction of the india-rubber cloth on our beds caused the most luminous flashes; they looked exactly as if the cloth had been rubbed with phosphorus, and the luminous appearance brought out afterwards by friction with the hand. This, however, is no new phenomenon, and is clearly of the same nature as that observed occasionally in Canada. The 'Times' of November 22nd, 1878, contains a letter on the subject, stating, apparently on good authority, that gas jets had been kindled at Government House, Ottawa, by the fingers of persons who, having trailed their feet along the carpet, and thus filled themselves with electricity, applied their finger exactly over the orifice of the gas pipe. The author of the letter to the 'Times' adds that he has lighted the gas himself, holding a knitting needle over the pipe, and has frequently seen it done by the finger.

On the 8th of July my camp at Guajara was struck, the mules were loaded, and we left for Alta Vista, 10,700 feet above the sea; the ascent was eventful in many ways, and on arrival I found the remains of Mr. Smyth's second station, which resembled those on the summit of Guajara. The air at this spot was neither quite so dry nor so cold at night as at the other place, although water in buckets was frozen before sunrise on one or two occasions. The most remarkable feature of this station in a meteorological point of view was its position, allowing of an extensive view over the cloud stratum below. My journal records for the 11th of July:—6.40 p.m., E and NE, as far as the eye can reach there is a motionless sea of clouds, with an appearance like enormous waves extending beyond the slopes of the lower hills of Teneriffe, about 4,000 feet below us.} In the NE, nearer to land, the waves assumed the form of a gigantic waterfall, or rather two falls meeting at an angle somewhat like Niagara. There was a smooth surface simulating water curling over a flat rock; while small masses of white foam-like vapour were visible below, rolling over each other until they seemed to reach land. Beyond the seat of this curious phenomenon the level white sea of clouds became lost far away at the horizon, where it terminated in a pink haze, gradually merging higher and higher in the sky into yellow, green, and blue. Before us, at a little distance, the Island of Grand Canary rises out of the clouds, which break asunder at one spot, displaying far down a blue band of real sea. On those clouds a huge, clearly defined shadow is projected, and which cannot be anything but that of the Peak with its culminating cone. 6.50 p.m.: We have been in the shade of evening for some little time; now the hill and rocks in the east are coloured bright red by the setting sun, and the tips of the waves on the sea of clouds glisten with a pink hue. To our right, or southwards, the clouds and horizon, and perhaps the sea, are all mixed together in a haze of the most delicate mauve colour, through which white hillocks of mist appear. At 7 p.m., a little to the right of the shadow of the Peak, the moon now appears, not quite full. Gradually the darkness increases, and nothing is left of the phenomenon but a light pink hue extending all over the visible horizon; it lasts but a minute or two and fades away. Such views were often seen during my stay at the Alta Vista station, though perhaps not to such a degree of perfection. This sea of clouds, in appearance so homogeneous and motionless, was ever moving in a southerly direction, and ceaselessly driving into space above.

The appearance as of a waterfall found an explanation later from the circumstance that the plateau of Laguna, a high tract of land at the north-eastern part of the Island, is comparatively damp, as there are several springs in that district; an upward current of moist, warm air, probably formed on that plateau, producing a rarefaction into which the clouds above were precipitated. They appeared, indeed, from the Peak to shoot down upon that very spot.

From Alta Vista I made two ascents to the summit of the Peak, 12,200 feet above the sea; and after remaining at the station for 10 days, the camp was struck, and the descent to Puerto effected.

The feeling experienced on entering the Trade wind clouds was most pleasant and refreshing, after spending so many days in such a dry, hot atmosphere; and it was quite a new sensation for me that night to sleep under a sheet only, with open windows, and longing for a little fresh air.

The hygrometrical readings at Puerto (dry bulb probably 0°·5 too high) showed a considerably higher degree of moisture than on the Peak, although at the time these observations were made the NE trade wind had all but ceased, and the Trade wind clouds had cleared away.

The mean difference between the dry and wet bulbs at Puerto between 10 or 11 a.m. and 6 or 7 p.m. on the 26th of July, was 8°·8; on the 27th, 7°·9;

and on the 29th, 7°·8. On this last day a puff of the NE Trade began at 10.42 a.m., bringing with it much moisture, and reducing the difference between the dry and wet bulbs from 10° at 10.42 a.m. to 4° at 11.15 a.m.; at 11.40 a.m. the breeze was lighter, and the difference between the readings increased at once to 8°.

Observations at Puerto de Orotava.

Date.	Dry Bulb.	Diff. between Dry and Wet.	Remarks.	Date.	Dry Bulb.	Diff. between Dry and Wet.	Remarks.
1878.—July.	°	°		1878.—July.	°	°	
26. 10.45 a.m.	77·0	9·5	Observations on the roof of a house by the sea-side, sheltered from sun. A clear sky. Mean 8°·8.	27. 1.40 p.m.	76·0	8·3	Observations in a garden. Clear sky. Mean 7°·9.
11.11 ,,	76·0	8·5		4.15 ,,	75·0	7·2	
11.40 ,,	78·0	10·2		4.50 ,,	75·0	7·0	
12.14 p.m.	78·5	10·0		5.15 ,,	74·5	7·0	
12.45 ,,	78·0	9·4		5.50 ,,	74·0	6·5	
1.43 ,,	79·0	11·0		6.20 ,,	73·0	6·0	
3.30 ,,	76·0	9·0		29. 10.10 a.m.	79·0	9·5	
4 ,,	75·0	8·5		10.42 ,,	78·0	10·0	Clear sky. NE breeze rising; a damp puff from NE trade, at 11.15 am. lighter. Mean 7°·8.
6.34 ,,	72·0	6·2		11.15 ,,	73·0	4·0	
7.7 ,,	71·0	5·8		11.40 ,,	77·0	8·0	
27. 10.40 a.m.	79·0	9·0	Observations in a garden. Clear sky.	12.15 p.m.	77·0	8 0	
11.15 ,,	79·0	9·0		12.45 ,,	77·0	8·0	
11.42 ,,	77·0	9·7		4.52 ,,	78·0	8·2	
12.5 p.m.	76·5	8·7		5.32 ,,	77·0	8·0	
12.35 ,,	76·0	8·5		6.4 ,,	75·0	6·5	
1.7 ,,	75·0	8·2					

Winds.—On my arrival at Puerto de Orotava the NE Trade wind was blowing a steady moderate breeze; my first station at the foot of the Guajara mountain was ill chosen for observations of the direction of the wind, as it was somewhat sheltered from the wind on the south side by the Guajara, and on the north, although to a lesser extent, by the Peak; it was therefore mostly exposed to the easterly and westerly winds. The following are my notes relating to the wind and its approximate direction while at that station:—

1878.

June 28.—6. a.m., wind W (2) puffy; increases to 4 in afternoon, puffy; 6.10 p.m., increased to 6 now subsiding.

,, 29.—Morning calm, light SE breeze from 10—11 a.m., nearly S in evening.

,, 30.—ENE breeze rising 9 a.m.; at noon strong S wind (7), puffy for about 2 hours, increasing to a gale (8) from S; calm at 6 p.m.

July 1.—Still at 6 a.m., light SSE and NE in afternoon.

,, 2.—Calm, light S and NE.

,, 3.—NE breeze all day, puffy, light and stiff alternately.

,, 4.—NE breeze, puffy (from 4 to 6).

,, 5.—Begins at 9 a.m. from NE and remains puffy.

,, 6.—Very light NE breeze, puffy in afternoon.

,, 7.—6 a.m. S and NNE breeze, light and puffy.

I arrived at Alta Vista on the 8th of July.

July 9th and 10th.—Light NNW breeze, puffy; night from 10th to 11th particularly boisterous, a gale from WNW, which continued throughout the 11th and abated towards evening.

„ 12.—9.30 a.m., very light westerly breeze. 3.45 p.m., nearly calm.

„ 13.—Strong west wind last night (6 to 7), and continues the same this morning; the same west wind noted as blowing hard at 6 p.m., while the sea appeared calm.

„ 14.—Gale last night, subsided long before dawn.

„ 15.—Ascent of the Peak, no particular breeze on Peak.

„ 16.—Clouds rising up to floor of Old Crater; a SSE breeze blowing.

„ 17.—A chilly west wind in the morning.

„ 18.—Apparently calm through the day, but at 7 p.m. a cold west breeze is blowing.

„ 19.—West wind blew hard last night, subsided before sunrise; and this morning is calm and comfortable. Apparently calm throughout the day; in the evening at 8 p.m. air noted as calm and warm: there is a remarkable change in the weather; sea now full in view through a mere haze, not a single cloud is to be seen over the sea.

It follows from the above remarks that at the Guajara station, 7,090 feet above the sea, there was still a tendency to the NE Trade wind, although a southerly gale blew on the 30th of June. On the other hand, at Alta Vista, at an altitude of 10,700 feet, the westerly winds prevailed, with an occasional northern tendency, and a rather greater amount of atmospheric moisture. There was consequently every appearance that the upper return SW current was beginning to be felt at that altitude, bringing back the moisture from between the Tropics; the wind was not yet, however, SW, but its westerly tendency was certainly apparent.

PROCEEDINGS AT THE MEETINGS OF THE SOCIETY.

May 21st, 1879.

Ordinary Meeting.

Charles Greaves, M.Inst.C.E., F.G.S., President, in the Chair.

A. C. Bamlett, Thirsk, Yorkshire;
Colville Browne, A.R.I.B.A., 5 Hilldrop Road, Camden Road, N.;
Henry Burkinyoung, 85 Cornwall Gardens, South Kensington, S.W.;
William Radford, Rainbow Villa, Allesley, Coventry; and
Fielden Ramsbotham, Crowborough Warren, Tunbridge Wells,
were balloted for and duly elected Fellows of the Society.

The adjourned Discussion on the Rev. W. Clement Ley's Paper, "On the Inclination of the Axes of Cyclones" (p. 167), was resumed and concluded.

The following Papers were read:—

"On Observations on the Velocities of the Wind, and on Anemometers." By G. A. Hagemann. (p. 203.)

"On the relation between the height of the Barometer, the duration of Sunshine, and the amount of Cloud, as observed at the Kew Observatory." By George Matthews Whipple, B.Sc., F.R.A.S., F.M.S. (p. 213.)

The Meeting was then adjourned.

JUNE 18th, 1879.

Ordinary Meeting.

CHARLES GREAVES, M.Inst.C.E., F.G.S., President, in the Chair.

Lieut. **ALFRED CARPENTER**, R.N., 45 Brunswick Square, Brighton;
HENRY DODD, The Hall, Rotherfield;
Capt. **DOUGLAS GALTON**, C.B., D.C.L., F.R.S., 12 Chester Street, Grosvenor Place, S.W.;
SAMUEL BENJAMIN GOSLIN, 29 Albert Road, Finsbury Park, N.;
ALEXANDER GRAY, 28 Strada Ridolfs, Sliema, Malta;
WILLIAM LAIRD MACGREGOR, care of Messrs. Roberts and Barlow, 7 Leadenhall Street, E.C.; and
Rev. **W. PERCY ROBINSON**, D.D., Trinity College, Glenalmond,
were balloted for and duly elected Fellows of the Society.

The following Papers were read:—

"Thermometer Exposure—Wall *versus* Stevenson Screen." By William Marriott, F.M.S., Assistant Secretary. (p. 217.)

"Report on the Proceedings of the Congress at Rome, in April, 1879." By ROBERT H. SCOTT, M.A., F.R.S., Foreign Secretary.

I HAVE to report that, in accordance with the instructions with which the Council honoured me, I expressed to the Congress the readiness of the Society to conform its practices, as far as possible, to the regulations laid down by international agreement.

No opening was afforded me to represent the Society in a more formal manner, inasmuch as no private association of meteorologists can be directly recognised at such a diplomatic meeting. This Society is the only one in existence, engaged in the prosecution of meteorology, and exhibiting real vitality, as evinced by its holding well-attended meetings, which enjoys the proud position of absolute independence in the management of its affairs from any governmental or official control. Long may it continue to hold to the well-known motto, "Nullius addictus jurare in verba magistri."

The Congress was attended by representatives from every nation in Europe except Turkey, and General Myer came from Washington three days too late. Austria sent five delegates, Italy eight (all of whom did not attend), France and Germany three, and some other nations, like this country, sent two.

The meetings began on the 14th of April, and it speedily became evident that an influential portion of the Congress, if not an actual majority, were not disposed to adopt resolutions of a very sweeping or obligatory character.

The general meetings were five in number, and at these there was hardly any debate; whereas at Vienna, there had been eleven general meetings, and a good deal of vigorous discussion.

However, the meetings of the sub-committees, of which there were five, were held frequently; and as those who represented extensive systems were obliged to take part in all the sub-committees, the work of a delegate who took a real interest in the proceedings was no sinecure, especially if he happened to be a Secretary, with his colleague *hors de combat*, owing to sickness at home.

The meetings were concluded on the 23rd, when the Congress took its departure for Naples. Before, however, I mention this part of the proceedings, I must submit to you the list of resolutions, noticing more particularly those which appear to me to present special interest to the Fellows.

The list of resolutions will form the final Appendix to the Report of the Congress.

As already noticed in the public press, the Congress was treated with the most splendid hospitality by the Italian government. Not only was there a banquet at the Palace, where all the members of the Congress were presented individually to the King and Queen, but the delegates were entertained by the Ministers, the Town Council, and the Scientific Societies, while the Government franked us all to Naples, and even to the top of Vesuvius.

In conclusion, if I were asked to say what was the chief feature and the abiding good of the Congress at Rome, I would answer that the series of reports on the various questions of the programme, which have been prepared by men of great eminence in the respective lines of inquiry, show that there is a great consensus of opinion in favour of the efforts made to replace by a solid permanent way the various tracks along which meteorology has hitherto been pursued. In fact, in our science every country has hitherto walked in the light of its own eyes, without much regard to the welfare or progress of the body politic.

DISCUSSION.

The **President** (Mr. Greaves) expressed the thanks of the Fellows to Mr. Scott for the excellent way in which he had represented the Society at the Meteorological Congress at Rome.

Mr. **Eaton** remarked that his experience of mountain stations was that many of them were not suitably situated for recording observations, they being generally in gorges where the true force and direction of the wind could not be obtained, and where the fall of rain and snow must be locally affected by eddies of wind. He had visited four of the Italian mountain stations to which these remarks would apply—viz., the Great St. Bernard, the Little St. Bernard, the Stelvio, and the Col di Valdobbia.

Mr. **Symons** was surprised at the great amount of work the Congress had got through, but he did not think that the resolutions respecting the compilation of a catalogue of meteorological works were such as to indicate that the members had fully considered the subject. He agreed with Mr. Eaton's remarks as to mountain stations, for at the Puy-de-Dôme, during winter, no less than 8 ins. of hoar frost were deposited on the thermometers, the readings of which could not be correct.

Dr. **Tripe** thought that the Conference might have recommended the simultaneous use of two balloons instead of one only on different days, as in that way the temperature and hygrometrical condition of currents of air at different elevations could be much more accurately ascertained.

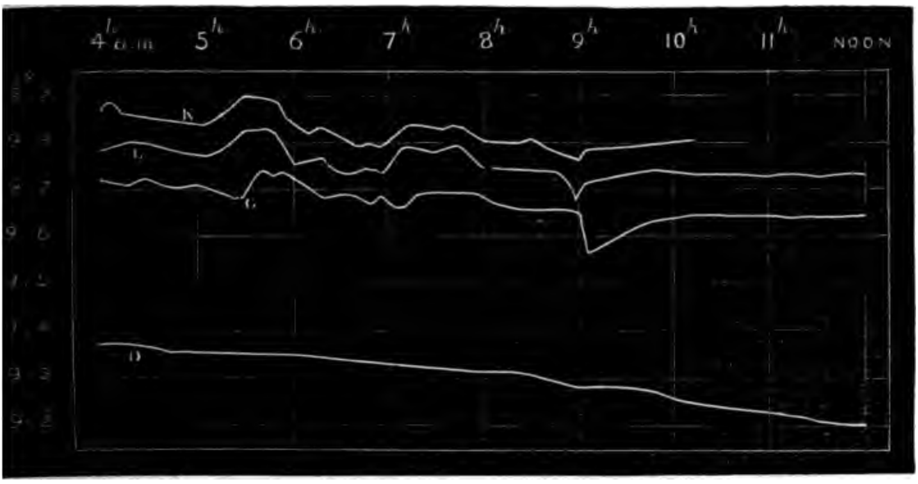
"Report on the Storm of the 20th and 21st of March, 1879, as experienced at the Royal Alfred Observatory of Mauritius." By CHARLES MELDRUM, M.A., LL.D., F.R.S., F.M.S. (p. 222.)

"Note on a remarkable disturbance of Barometric Pressure observed at the Royal Observatory, Greenwich, on the 18th of May, 1878." By WILLIAM ELLIS, F.R.A.S., F.M.S., of the Royal Observatory.

THOSE persons who have had much occasion to examine self-registered barometric records will, probably, have noticed that, although the motion of the barometric column is usually smooth, it sometimes exhibits considerable irregularity. It is not with the wide ranges of pressure experienced in the storms of winter that such disturbances are most numerous; they are, rather, the characteristic of the thunderstorms of summer. So peculiar, indeed, are the changes at such times frequently observed, that it is easy to select from the Greenwich photographic sheets days on which, from the character of the record, it is pretty certain that thunderstorms were prevalent.

On the morning of the 18th of May, 1878, a very remarkable case of disturbance occurred. During the preceding night there had been a succession of thunderstorms, but no thunder was heard at Greenwich after 8 a.m Rain had fallen frequently since 1 a.m., ceasing finally shortly after 9 a.m. The first indication on the Greenwich barometric record of the peculiar irregularities at such times seen occurs at about 1 a.m., and the record continues disturbed until 10 a.m. It was just at 9 a.m., as shown in the accompanying diagram, that the sudden change took place which induced me to draw up this note; the barometer at this time fell 0·085 in. in rather less than five minutes, a very unusual rate of change in this latitude, even in a disturbed state of atmosphere.

Mr. Scott and Dr. Copeland having kindly communicated to the Astronomer Royal the corresponding barometric curves for Kew and Dunecht respectively, copies of these have been added on the diagram. Some of the irregularities occurring at the earlier morning hours are therein included, and may be seen both in the Greenwich and Kew curves, but the disturbances were evidently not sensible at Dunecht. At 9 a.m., when the rapid change occurred at Greenwich, no corresponding change appears on the Kew curve; there is, indeed, at this time a slight tendency in the opposite direction. The Milne barograph in the Meteorological Office, which records at every hour, indicated a fall of 0·065 in. between 8 and 9 a.m., confirming, to a considerable extent, the Greenwich record; but the barometers at the other Observatories in connection with the Meteorological Office do not seem to have been affected to any important extent. The direction of the wind during the night had been generally S and SE, its force being at no time great.



D = Dunecht; G = Greenwich; K = Kew; L = London (Belgrave Square).

The remarkable circumstance in connection with the disturbance is that it occurred after the night thunderstorms (at Greenwich) had finally passed off, and when, to all appearance, the atmosphere had regained a comparatively tranquil state, no thunder in the vicinity of Greenwich having been heard since before 8 a.m. One three hundred and fiftieth part of the whole atmospheric pressure was suddenly removed, and, which seems also noteworthy, the previously existing pressure was, in the course of an hour, gradually restored. That is to say, if, neglecting the actual change, a line be drawn joining the Greenwich trace just previous to 9 a.m. with its position at 10 a.m , such line would, apparently, better harmonise with the general change previous to 9 a.m. and following 10 a.m., than does the real change. Whatever caused the sudden and sharp fall at 9 a.m., it seems that a compensating action immediately set in, which, in the course of an hour, restored the pressure to that which it would have been had the slow change going on previously to 9 a.m. continued to progress without having been so sharply disturbed.

[Added July 10th, 1879.] Since the note above was written, the Hon. R. Abercromby has kindly sent me a copy of his barometric trace, recorded close to Belgrave Square, London. This interesting addition I have placed also on the diagram, putting the record 0·1 in. lower than it appears in the original, in order to avoid interference with the Kew curve. Comparing now the Greenwich, Kew, and London traces, it appears that the 9 a.m. disturbance commenced earliest at the most western station (Kew); at the intermediate station (London) it commenced later, and was of sharper character, whilst at the most eastern station (Greenwich) it commenced still later, and was most marked. It would be interesting to ascertain if possible what took place still further east than Greenwich. The two features to which I have specially wished to direct attention are, firstly, the unusually large change (for this latitude) occurring in so short a time; and, secondly, the comparatively tranquil state of atmosphere accompanying the disturbance.

DISCUSSION.

Mr. **Strachan** wished to know whether rain was falling at the time of this sudden depression. He then referred to some remarkable barometric oscillations mentioned by Mr. E. Clark, in his book on "A Visit to South America." "At Buenos Ayres, May 1st, 1877, at 10.28 p.m., the barometer rose from 29·60 ins. to 29·79 ins. in one minute, and in one minute more it fell from 29·79 ins. to 29·58 ins. In four minutes more it rose from 29·58 ins. to 29·81 ins. The first rapid rise was due to the air being compressed by a torrent of rain which came like an explosion overhead. The second rise was due to the rebound, and then followed the oscillation to restore equilibrium."

Mr. **Scott** said that Mr. Eliot had shown that such sudden oscillations of temperature and pressure with NW winds were probably connected with actual downward motion of the air currents, at least in India.

Mr. **Eaton** said he had often noticed in summer thunderstorms that the barometer rose during a heavy fall of rain, and fell immediately after its cessation. This was specially the case when there was an easterly surface current of wind, with rocky cirro-stratus above moving from the S or SW.

Mr. **Symons** said that his barograph always showed a peculiar rise during a shower or sudden fall of rain.

Mr. **Scott** mentioned that he had heard that the late Mr. Manuel Johnson, of Oxford, had stated that by looking at his barogram he was able to say whether rain, snow, or hail was falling at the time the record was taken.

Mr. **Ellis**, in reply, said that at the time of the depression which was the subject of his communication a little rain was falling, and the wind was very light.

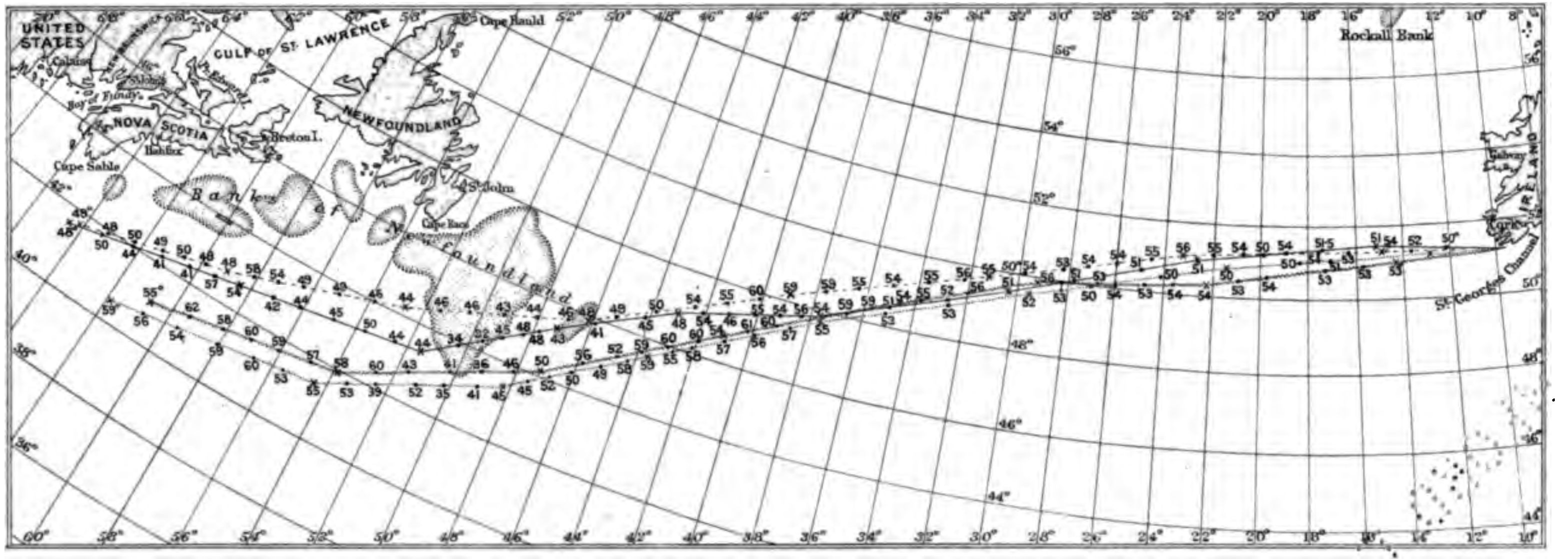
"On the Meteorology of Mozufferpore, Tirhoot, during the year 1878." By Charles N. Pearson, F.M.S. (p. 226.)

"Meteorological Observations on the Peak of Teneriffe." By William Marcet, M.D., F.R.S., F.M.S. (p. 227.)

"Comparison between the Temperature of the North Atlantic and of Great Britain in December 1877 and 1878." By Captain Henry Toynbee, F.R.A.S., F.M.S. (Plate XXVII.)

I have received a chart from Captain Watson, F.M.S., commanding the Cunard Steamer 'Algeria.' On it he has plotted his outward and homeward tracks to America during the Decembers of 1877 and 1878, together with the temperature of the sea every four hours. A reduction of this Chart, with some observations omitted to avoid crowding, is given on Plate XXVII. I have carefully compared the temperatures of the two outward tracks, going west, and also those of the two homeward, coming east. Of 39 comparisons outward, 36 showed the temperature of the sea in 1878 to be warmer than that of 1877, and 3 showed it

SEA SURFACE TEMPERATURES OBSERVED BY CAPTAIN Wm. WATSON, F.M.S.



The track represented thus ——— *is for Dec. 1877, — Ship going to the W.*
" " " ········ " " " " *E.*
" " " - - - - - " *1878,* " " " *W.*
" " " 〰〰〰 " " " " *E.*
A dot (•) *on the track shows the position of ship at the time of each observation.*
" *cross* (×) " " " " *Noon each day.*

to be colder, the mean difference being 3°·6; of the 33 comparisons homeward, 28 showed the temperature of the sea in 1878 to be warmer than that of 1877, and 5 showed it to be colder, the mean difference being 2°·8; the mean for the outward and homeward passages showing that the part of the Atlantic traversed was 3°·2 warmer in December 1878 than in December 1877. Knowing that some meteorologists suppose that the difference in the temperatures of the winters experienced in the British Isles depends on that of the sea to the westward, I got from the Meteorological Office the accompanying comparison of the temperatures at various land stations for Decembers of the two years:—

The Temperature of December, 1877, compared with that of December, 1878.

	December 1877.		December 1878.	
	Mean.	**Diff. from Average.**	**Mean.**	**Diff. from Average.**
A. **Mean of 744 hourly readings at Valentia, Armagh, Glasgow, Aberdeen, Stonyhurst and Kew, compared with the Averages used for the Tables of the Quarterly Weather Report**	41°·5	+0°·6	33°·1	—7°·9
B. **Mean of 2 observations daily at 13 Stations of the Second Order over the British Islands, compared with Mr. Buchan's Averages for 13 years for the same Stations** ..	42·1	+0·3	33·7	—8·3
C. **Comparison of Mean Temperatures obtained from 2 observations daily at 30 approved Stations in Great Britain, 8 of which are included in B above**	40·3	..	32·5	—7·8

Note.—In C. the individual differences are all "—," ranging from —5°·6 at Ramsgate to —12°·1 at Markree Castle.

The result is that over the British Islands the December of 1878 was about 8° colder than that of 1877, in spite of the fact that the sea to the westward was more than 3° warmer. These facts seem to prove that we must look elsewhere for the cause of our varying seasons. Perhaps I may be allowed to suggest that the difference of our seasons depends upon the tracks of the areas of low pressure which cross Great Britain. If they pass over the northern parts of these Islands they give rise to southerly and south-westerly winds with warm weather, while if they pass to the southward they bring easterly and north-easterly winds. It is generally allowed that the tracks of areas of low pressure depend upon the disposition of areas of high pressure, and that areas of low pressure generally move to the eastward on the northern side of the area of high pressure which usually exists in the centre of the North Atlantic. Hence it seems reasonable to suppose that any difference in the atitude of this area of high pressure may be the cause of the difference in our seasons; if so, a few years of synchronous observations over the Atlantic will throw light on this important subject. No one can watch the Daily Weather Charts issued by the Meteorological Office without seeing that our winters are also very much affected by the formation of areas of high pressure to the northward and north-eastward of these Islands, checking as they do the easterly movement of areas of low pressure which appear on our west coasts, and causing a continuance of northerly winds. This disposition of pressure was common during the winter of 1878-79.

The Meeting was then adjourned.

RECENT PUBLICATIONS.

Andamento Annuale della Umidita Relativa e Assoluta del Prof. D. Ragona. Modena, 1879, 67 pp. 4to.

This is an elaborate discussion of the relative and absolute Humidity Observations made at the Royal Observatory, Modena, during the 12 years 1866-77.

Annual Report of the Chief Signal Officer to the Secretary of War for the year 1878. 8vo, 679 pp.

This contains an account of the proceedings of the U. S. Signal Office for the twelve months ending June 30th, 1878. On this date, the total number of stations of observation in operation and communicating with the office was 203, within the territory of the United States; and the number from which full telegraphic reports were received tri-daily was 113. Tables are given of monthly and annual mean pressure, maximum, minimum, and mean temperatures, and amount of rain, as well as daily maximum and minimum temperatures. Among other papers are: Rain and dry winds computed for different geographical districts. Reports on Tornadoes of February 7th and 8th, 1878, Richmond and Burke counties, Georgia, and at Wallingford, Conn., on August 9th, 1878.

Annuario della Societa Meteorologica Italiana. Vol. II., Nos. 29-44, 8vo.

This publication is edited by Prof. D. Ragona, of the Royal Observatory, Modena, and consists principally of short notes on the results of observations, with occasional longer papers. Among other communications are the following:—Rosa Pluviometrica per l' orizzonte di Modena.—Sui confronti barometrici e sulla riduzione del barometro a 0°.—Nuovo barometro a zero constante.—Sulle variazioni annuali delle temperature massime e minime.—Sulla scintillazione delle stelle, del Prof. C. Montigny.

Annuario del Observatorio de Madrid. Ano XVII., 1879, 8vo.

The third Part (187 pages) consists of "Definicion aproximada del Clima de Madrid," by M. Merino, which is an extensive discussion of the meteorological observations for the decade 1860—1869.

Comment on observe les Nuages pour prevoir le Temps. Par Andre Poey. Troisième Edition. Paris, 1879. 172 pp., 8vo.

This work is divided into seven chapters, which treat of the former classifications of clouds; discussion of Howard's classification; errors of meteorologists; new classification of clouds; the structure and forms of clouds; estimation of the amount, direction, motion and azimuthal rotation of clouds; the nature of clouds deduced from halos, coronas and rainbows; experimental and synthetic considerations on the structure and form of clouds. M. Poëy proposes two new names, viz. 1. *Tracto-cirrus*, or "Polar-bands;" and 2. *Globo-cirrus* and *Globo-cumulus*, or the "Pocky-clouds." The book is illustrated by 17 chromo-lithographs and 3 woodcuts, and also contains a bibliography of the authors quoted in the work.

Comptes Rendus Stenographiques des Congres Internationaux de l'Exposition Universelle de 1878. No. 20, Congrès International de Météorologie. 1879, 274 pp. 8vo.

This Congress was held at Paris, from August 24th to 28th, 1878, in connection with the International Exhibition. The present volume contains a full report of the proceedings and discussions at the meetings, as well as 25 papers *in extenso*, the titles of which are:—1. P. F. Denza: Organisation du service météorologique en Italie.—2. Capt. N. Hoffmeyer: Distribution de la pression atmosphérique pendant l'hiver sur l'océan Atlantique septentrional, et influence qui en résulte sur le climat de l'Europe.—3. M. de Tastes: Quelques remarques sur les grands mouvements de l'atmosphère, au point de vue de la prévision du temps.—4. Comte Sansac de Touchimbert: Les courants aériens.—5. M. J. J. Collins: Des mouvements des bourrasques et de la possibilité des avertissements météorologiques entre l'Amérique et l'Europe.—6. M. Hébert: Etude sur les grands mouvements de l'atmosphère et sur le mode de formation des tourbillons atmosphériques.—7. Abbé Rougerie: Théorie des rapports qui existent entre la pression barométrique moyenne d'un point de l'Atlantique Nord, et la direction de la vitesse des vents, en ce même point, pendant les mois d'été.—8. Prof. D. Ragona: Nouvelles lois sur la vitesse du vents, déduites de onze années d'observations anémométriques faites à l'observatoire de Modène.—9. M. G. Tissandier: Météorologie des hautes régions de l'atmosphère; résumé des observations faites dans le cours de vingt-deux ascensions aérostatiques.—10. M. E. Renou: Détermination de la température de l'air.—11. M. Alluard: Des variations nocturnes de la température à des altitudes différentes, constatées à l'observatoire du Puy-de-Dôme.—12. M. Fautrat: Météorologie forestière.—13. M. G. Lemoine: Notice sur l'annonce des crues et sur les observations hydrométriques.—14. Abbé Richard: Communication sur la diminution des sources et de l'eau à la surface de certains continents.—15. Dr. Bérigny: L'ozonométrie.—16. Dr. Borius: De l'identité des résultats fournis au Sénégal par l'observation de l'évaporomètre de Piche et du papier ozonométrique de Jame (de Sedan).—17. M. A. Louvet: Mémoire sur la question; "Quelle est la valeur des papiers ozonométriques?"—18. Dr. G. Daremberg: Sur la valeur des papiers ozonoscopiques ioduro-amidonnés.—19. M. F. Alexander: Note relative à la mesure de l'évaporation de l'eau.—20. M. A. Crova: Communication sur des instruments destinés aux mesures de l'intensité calorfique des radiations solaires.—21. M. J. Violle: Sur un nouvel actinomètre.—22. M. C. Montigny: Recherches sur la scintillation des étoiles et description d'un scintillomètre.—23. M. C. Montigny: Mesures d'altitudes barométriques prises à la tour de la cathédrale d'Anvers sous l'influence de vents de vitesses et de directions différentes.—24. M. Montani: Mémoire sur les périodes anomales.—25. M. Viguier: Indication d'une étude critique sur la grêle.

JAHRBUCH DES NORWEGISCHEN METEOROLOGISCHEN INSTITUTS FUER 1877. Herausgegeben von Dr. H. MOHN. 4to.

This contains detailed daily observations from 12 stations, and monthly and annual results from 42 stations.

OVERSIGT OVER VEIRFORHOLDENE I NORGE I AARET 1878. Ved Karl Hesselberg. 8vo.

This contains tables of the mean temperature and total rainfall for each month and for the year, and their deviation from the average, together with some general remarks on weather in Norway during the year.

JAHRBUECHER DER K. K. CENTRAL-ANSTALT FUER METEOROLOGIE UND ERDMAGNETISMUS. Officielle Publication, Jahrgang 1876. 4to.

This contains:—I. Detailed daily observations at 6 a.m., 2 p.m., and 10 p.m., from 15 stations, including Alexandria, Beyrout, and Corfu. II. Monthly and yearly results from more than 200 stations. III. Magnetic Observations made at Vienna. IV. Report on the Phenological Observations, by Dr. C. Fritsch. V. Hourly Readings from the self-recording instruments of Pressure, Temperature, and Wind, at the Vienna Observatory.

JOURNAL OF THE ASIATIC SOCIETY OF BENGAL. Vol. XLVIII. Part II. 1879. 8vo.

Contains:—On the Diurnal Variation of Rainfall Frequency at Calcutta, by H. F. Blanford. This is a discussion of the hourly observations recorded at the Surveyor General's Office from August 1856 to March 1877, from which the following conclusions are drawn. On the average of the year, which average is mainly determined by that of the summer monsoon months, the hour at which rain is least frequent is shortly before midnight, and that at which it is most so from 2 to 3 p.m. The latter accords approximately with the diurnal epoch of maximum temperature, but the former does not accord with its minimum; and, indeed, the frequency of rain at the hour of mean minimum temperature is nearly 40 per cent. greater than at midnight, while at the hour of its maximum it is only twice as great; and it would rather appear that while the greatest heat coincides with a principal maximum of rainfall, the greatest cold coincides with a secondary maximum. The character of the variation in the rainy months of the summer monsoon does not differ materially from the above. But that of the hot season is very different; and that of the cold season again differs from both, and is more uniform than either.

JOURNAL OF THE LIVERPOOL POLYTECHNIC SOCIETY, April, 1879. 8vo.

Contains a description of a Hygrometer by Mr. Bogen. By compression of an india-rubber ball, water is forced from a lower cup to a higher, which contains some crystals of nitrate of ammonia: as these dissolve the temperature is lowered; and the dew-point, shown by the dimming of a bright platinized surface, is read off by means of a thermometer whose bulb is immersed in the water.

JOURNAL OF THE SCOTTISH METEOROLOGICAL SOCIETY. Nos. LVII.—LIX. 8vo.

The principal contents are:—The Great Plague of London in relation to Weather, by Dr. A. Mitchell and A. Buchan.—Third Report on the relations of the Herring Fishery to Meteorology, by A. Buchan.—The Temperature of the Sea at Peterhead for each day of the year, from observations made with thermometers continuously immersed, by A. Buchan.—On the connection between the severe winter and spring of 1878-79 and the failure of the Salmon Fishing in the early rivers, by A. Young.—Description of arrangements for observations of Sea and River Temperatures with thermometers continuously immersed, by T. Stevenson.—On the effects of Land Drainage on the productiveness of Salmon Rivers; with remarks on the Salmon Disease, by A. Young.—On observations relative to the Temperatures to which the Human Body is exposed, by Professor G. Forbes.

OBSERVATIONS MADE AT THE MAGNETICAL AND METEOROLOGICAL OBSERVATORY AT BATAVIA UNDER THE DIRECTION OF DR. P. A. BERGSMA. Published by order of the Government of Netherlands, India. Vols. II. and III. Folio.

It was not till 1873 that the Government granted the necessary funds for building the Batavia Observatory; but previously to this Dr. Bergsma rented a house and adapted it as a temporary observatory, where he commenced on January 1st, 1866, with a staff of Javanese assistants, hourly meteorological and magnetical observations, which have been continued to the end of 1878, when they were to be superseded in the new observatory by photographic and self-recording instruments. The present volumes contain the hourly meteorological observations from January, 1, 1869, to December 31, 1875, and the magnetical observations from July 1, 1870, to July 31, 1875.

REPORT ON THE MADRAS CYCLONE OF MAY 1877. By J. ELIOT, M.A., Meteorological Reporter to the Government of Bengal. 1879. 214 pp., 4to.

The object of this work is to set forth in full detail for present and future investigation and information, the atmospheric phenomena which preceded and accompanied the most recent cyclone in the Bay of Bengal, The first part contains the investigation of the cyclone arranged under nine chapters, viz.:— 1. Introductory; 2. Meteorology of India and the Bay of Bengal during the transition periods preceding and succeeding the SW monsoon; 3. Meteorology of the period, May 1st to 12th, antecedent to the formation of the cyclone; 4. Meteorology of India and the Bay of Bengal during the formation and advance of the cyclone; 5. History of the formation, advance and dissipation of the cyclone; 6. Cyclone distribution and probability in the Bay of Bengal; 7. Brief analysis of the Madras Cyclone of May 1851, and of the Midnapore Cyclone of October 1874; 8. Causes of cyclone generation in the Bay of Bengal, with special reference to Dr. Hann's theory; and 9. General conclusions respecting cyclone generation, motion and occurrence. The second part gives *in extenso* the original observations and information upon which the investigation is based. Mr. Eliot believes that this discussion is conclusive in favour of the condensation theory of the origin of cyclones in the Bay of Bengal.

TRANSACTIONS AND PROCEEDINGS AND REPORT OF THE PHILOSOPHICAL SOCIETY OF ADELAIDE, SOUTH AUSTRALIA, for 1877-78. 8vo.

Contains: A new theory of Whirlwinds, by Otto Tepper. The conclusions arrived at are:—1. Whirlwinds are upward currents of heated air, endowed with a spiral motion at the circumference, progressive motion and small diameter in proportion to their height. 2. They only occur during the warmest part of the year and day, and in calm weather. 3. They are due to the unstable equilibrium of the air, the hot lower portion acquiring a high state of tension by being unable to rise according to the laws of heat, being prevented by some rapidly moving current of cold air. 4. They are produced by the hot air obtaining exit through a narrow vent forced through the upper current. 5. Their locomotion is produced by the vent and its cross air current being carried along with the cold current. 6. Their spiral motion is produced by the shifting of the centre of attraction (the vortex) of the hot air particles and their infringement upon each other, and the unaffected volume of the adjacent air, assisted by friction. In fact they are produced by the same causes, only inversely, as the rotating motions of fluids escaping through a narrow vent below them. 7. They are terminated by the closing of the vent by the onward pressure of the cold current. 8. The retention of light articles in the upper regions (even perhaps their ascension) may be greatly facilitated by electricity. 9. Stable equilibrium is produced by the escape of the overheated air, and its replacement by cold air derived from the upper current or the SW surface wind.

Transactions and Proceedings of the Royal Society of Victoria. Vol. XV. 8vo.

Contains a description of a new form of self-registering Rain Gauge, by R. L. J. Ellery, F.R.S. The vessel, which receives the rain, is suspended from a fixed bracket by two spiral springs, and descends as its weight is added to, marking as it does so a trace on a revolving drum. At each 0·25 in. of rain it is emptied by an intermittent siphon, and rises again, registering, as before, its trace on the drum.

Einiges ueber Witterungs Angaben, von Hermann Kopp. 1879, 8vo.

In the winter of 1877 Prof. Kopp gave a lecture at Heidelberg on the History of Weather Study. This he has now developed into a book of 140 pages, uniform with his History of Chemistry, and to the full as replete with historical lore as that was. He separates Weather Study into 3 periods: The first deals with *weather as it has been*—"Climatology"; the second with *weather as it is*—"Daily Weather Charts"; and the third with *weather as it will be*—"Forecasts." His accounts of astrological weather prophecies are especially interesting.

Zeitschrift der Oesterreichischen Gesellschaft fuer Meteorologie. Redigirt von Dr. J. Hann. XIV. Band, August-October, 1879, 8vo.

Contains:—Ein Einwirkung des Görzer Klima's auf die Vegetation, von C. F. v. Czoernig.—Ueber die Transpirationsgrössen der förstlichen Holzgewächse mit Beziehung auf die förstlich-meteorologischen Verhältnisse, von Dr. F. R. v. Höhnel.—Klima der Loangoküste in West Afrika.—Ueber eine zehnjährige Periode in der jährlichen Aenderung der Temperatur und des Luftdruckes in Nord-Indien, von S. A. Hill.—Notiz über die Rückführung der Anemometerangaben der Stationen der Seewarte auf absolutes Maass und über das Verhältniss von Beaufort's Scala zur Windgeschwindigkeit, von Dr. W. Köppen.—Die Niederschlags-Verhältnisse im Flussgebiete der Theiss, von J. Riedel.—Die tägliche Periode der Geschwindigkeit und der Richtung des Windes, von Dr. W. Köppen.—Folgen der Entwaldung für Klima und Wasser, von Dr. E. Ebermayer.—Das Evaporimeter "Piche" und seine Angaben in Beziehung zur Verdampfung freir Wasserflächen, von Dr. W. Riegler.

Zeitschrift des Deutschen und Oesterreicheschen Alpenvereins, 1879. Anleitung zu wissenschaftlichen Beobachtungen auf Alpenreisen. 8vo.

The second of these articles is a paper by Dr. J. Hann, entitled "Einführung in die Meteorologie der Alpen."

DONATIONS RECEIVED FROM JULY 1ST TO SEPTEMBER 30TH, 1879.

Presented by Societies, Institutions, &c.

Adelaide	**Observatory**	**Meteorological Observations, Augu October, 1878.**
Batavia	**Observatory**	**Magnetical and Meteorological Ob tions, Vols. II. and III.**
Bombay	**Meteorological Office**	**Report on the Administration of th teorological Department in W India, 1878-9.**
Brisbane	**General Register Office**	**Report on the Vital Statistics, May t 1879.**
Brussels	**Observatoire Royal**	**Annales Météorologiques de Bru April to May, 1879.**
	” ”	**Annales Météorologiques. Obser des Stations Climatologiques, Parts 8-14.**
	” ”	**Bulletin Météorologique, June to 1879.**
	” ”	**Observations Météorologiques fait stations internationales de la B et des Pays-Bas, September, 1878**
Calcutta	**St. Xavier's College Observatory**	**Meteorological Register, July 1878, t 1879.**
Christiania	**Norske Meteorologiske Institut**	**Oversigt over Veirforholdene i N Aaret 1878, ved Karl Hesselberg.**
Copenhagen	**Danske Meteorologiske Institut**	**Bulletin Météorologique du Nord, August, 1879.**
Cracow	**K. K. Sternwarte**	**Meteorologische Beobachtungen, Ju July, 1879.**
Dublin	**Royal Irish Academy**	**Proceedings. Science, Vol. III., N Literature, Vol. I., No. 13.**
	” ”	**Transactions. Science, Vol. XXVI. 17-21. Literature, Vol. XXVII.,**
Edinburgh	**Scottish Meteorological Society**	**Journal, Nos. 57-59.**
Geneva	**Société de Géographie**	**Le Globe. Tome XVIII., Livraisons**
Hamburg	**Deutsche Seewarte**	**Wetterbericht, July to September,**
	” ”	**Monatliche Uebersicht der Wit May to June, 1878.**
Kew	**Observatory**	**Report of the British Association,**
London	**Foreign Office**	**Comptes Rendus Sténographiqu Congrès International de Météo tenu à Paris du 24 au 28 Août, 18**
	General Register Office	**Weekly Returns of Births and Death Nos. 26-38.**
	” ”	**Quarterly Return of Marriages, Birt Deaths, June 30th, 1879.**
	India Office	**Account of the operations of the Trigonometrical Survey of India II.-IV.**
	Meteorological Office	**Daily Weather Reports, July to Sept 1879.**
	” ”	**Weekly Weather Reports, 1879. Nos**
	” ”	**Bulletin quotidien de l'Algérie, June September 15th, 1879.**
	Royal Astronomical Society	**Monthly Notices, Vol. XXIX., No. 8**
	Royal Society	**Proceedings, Nos. 196 and 197.**
	Society of Arts	**Journal, Nos. 1389-1401.**

London	Society of Public Analysts	The Analyst, July to September, 1879.
	Treasury	Royal Society Catalogue of Scientific Papers, Vols. I. to VIII.
Madrid	Observatorio	Annuario, 1877-1879.
	,,	Observaciones Meteorológicas efectuadas en el Observatorio de Madrid, 1874-1875.
	,,	Resúmen de las Observaciones Meteorológicas efectuadas en la Peninsula, 1874-1875.
	Sociedad Geográfica	Boletin. Tomo VI., No. 6. VII., 1-3.
Melbourne	Observatory	Monthly Record of Results of Observations in Meteorology, Terrestrial Magnetism, &c., January to April, 1879.
Mexico	Ministero de Fomento	Boletin. Tomo IV. Nos. 63-101.
	Observatorio Astronómico Central	Determinacion de la Longitud del pendulo de Segundos y de la Gravedad en Mexico á 2283m sobre el Nivel del Mar, por F. Jimenez y L. Fernandez.
Modena	Societa Meteorologica Italiana	Annuario. Vol. II., Nos. 29-44.
Moncalieri	Osservatorio del R. Collegio Carlo Alberto	Bullettino Meteorologico, 1879, Nos. 1-4.
	,, ,,	Osservazione Meteorologiche, April to June, 1879.
Munich	K. B. Meteorologische Central-Station	Uebersicht über die Witterungsverhältnisse im Königreiche Bayern. May to August, 1879.
	,, ,,	Beobachtungen der Meteorologischen Stationen im Königreiche Bayern. Vol. I., Part 2.
New York	Central Park Observatory	Abstracts of Registers from Self-Recording Instruments, May to July, 1879.
Paris	Bureau Central Météorologique	Bulletin International, July to September, 1879.
	Société Météorologique de France	Annuaire, Bulletin des Seances, 1879. Feuilles 1-9.
Philadelphia	American Philosophical Society	Proceedings, No. 102.
Rome	Ministero della Pubblica Instruzione	Bollettino Mensile, December 1878, to January 1879.
	,, ,,	Meteorologia Italiana, Memorie e Notizie. Anno 1878, Fascicolo IV.
	,, ,,	Meteorologia Italiana. Riassunto Mensile ed Annuale per l' anno, 1878.
	Osservatorio del Collegio Romano	Bullettino Meteorologico, January 1879.
Sydney	Observatory	Results of Rain Observations made in New South Wales in 1878, by H. C. Russell, B.A.
Upsala	Observatoire de l'Université	Bulletin Météorologique Mensuel, September to December 1878.
Vienna	K. K. Central-Anstalt für Meteorologie und Erdmagnetismus	Beobachtungen, May to July, 1879.
	,, ,,	Jahrbuch 1876.
	Oesterreichische Gesellschaft für Meteorologie	Zeitschrift, July to September, 1879.
Washington	Smithsonian Institution	Report for 1877.
	,, ,,	Sketch of the Life and Contributions to Science of Prof. Henry, LL.D.
	War Department	Daily Bulletin of Weather Reports, with the Synopses, Probabilities and Facts, November 1874, to January 1875, January to March, 1877.
	,, ,,	Monthly Weather Review, May to July, 1879.
	,, ,,	Annual Report of the Chief Signal Officer, 1878.
Watford	Natural History Society	Transactions. Vol. II., Parts 4-5.

Presented by Individuals.

Aldridge, E. G.	Table of the Temperature of New Zealand, 1866-77.
Barcena, M.	Estudio del Terremoto del 17 de Mayo de 1879.
Blanford, H. F., F.G.S.	On the Diurnal Variation of Rainfall Frequency at Calcutta.
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Hankinson, R. C.	Weather at Red Lodge, Southampton, June to August, 1879. (MS.)
Hann, Dr. J.	Einführung in die Meteorologie der Alpen ('Hints on Meteorological Observations at Mountain Stations').
Hoffmeyer, Capt. N.	Distribution de la Pression Atmosphèrique.
Hoskins, Dr. S. E., F.R.S.	Meteorological Observations, Guernsey, June to August, 1879.
Loomis, Prof. E.	Contributions to Meteorology; Eleventh Paper.
Mohn, Dr. H.	Norges Klima.
Newnham, Rev. P. H., M.A.	The Climate of Bournemouth.
Pittei, C.	Congresso Internazionale di Meteorologia a Roma.
Preston, Rev. T. A., M.A.	Wiltshire Rainfall, June to August, 1879.
Prince, C. L., F.R.A.S.	Observations upon the Temperature and Rainfall of the past Summer (1879).
Ragona, Prof. D.	Andamento Annuale della Umidità Relativa e Assoluta,
Silver, S. W., F.R.G.S.	The Colonies and India. Nos. 358-371.
Symons, G. J., F.R.S.	Symons's Monthly Meteorological Magazine, July to September, 1879.
"	Address upon Water Economy.
"	Elémens de Géographie Physique et de Météorologie, par Prof. H. Lecoq.
"	Grundriss der Meteorologie herausgegeben von Dr. E. E. Schmid.
"	Les Changements Périodiques de Température par Dr. C. H. D. Buys Ballot.
"	Ephemerides Societatis Meteorologicæ Palatinæ. Observationes, anni 1790.
"	Het Regt gebruik der Natuur-Beschowingen geschetst in eene Verhandeling over de Sneeuw Figuuren door Jan Engelman, M.D.
"	Also 31 other Books and Pamphlets.
The Editor	Academy. No. 374.
"	Nature. Nos. 505-517.
"	Telegraphic Journal and Electrical Review. Nos. 154-159.
Whitmore, Dr. J.	Health and Meteorology of Marylebone, June and July, 1879.
"	Annual Report of the Health of the Parish of St. Marylebone, 1878.
Wragge, C. L., F.R.G.S.	The Autumn, Winter, and Spring of 1878-9 in the vicinity of the Staffordshire Moorlands and Churnet Basin, from observations taken at Farley, near Cheadle.

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THE END.

REPORT

ON THE

METEOROLOGY OF ENGLAND

FOR THE YEAR

1879,

WITH

MONTHLY ABSTRACTS OF OBSERVATIONS MADE AT THE STATIONS

OF THE

METEOROLOGICAL SOCIETY.

BY

WILLIAM MARRIOTT,

Assistant-Secretary.

Report on the Meteorology of England for the Quarter ending MARCH 31ST, 1879, *with Monthly Abstracts of Observations made at the Society's Stations.* By WILLIAM MARRIOTT, Assistant-Secretary.

ATMOSPHERIC PRESSURE.—In *January* the mean pressure, reduced to sea-level, was 30·04 in. The highest readings were in the central and eastern districts, and the lowest in the SW. The maximum occurred on the evening of the 27th, the highest reading reported being 30·529 in. at Buxton and Shrewsbury; the minimum took place on the 1st, in the SW; on the 3rd, in the midland and eastern districts; and on the 14th or 15th, in the NW and N, the lowest recorded being 29·318 in. at 9 p.m. on the 1st at Babbacombe.

In *February* the pressure was deficient, the mean being only 29·53 in. The readings were highest in the SE, and lowest in the N and NW. The maximum reading occurred in the SE and E on the morning of the 1st, and in the SW and NW on the 26th, the highest reported being 30·169 in. at 9 a.m. on the 1st, at Lowestoft, and 30·234 in. at 9 a.m. on the 26th, at Babbacombe and Dartmoor; the minimum took place at all stations on the 10th, the lowest being 28·772 in. at 1·45 p.m. at Babbacombe.

In *March* the mean was 29·98 in. The readings followed the same order as in the previous month—viz. the highest being in the SE, and the lowest in the N and NW. The maximum occurred at all stations on the evening of the 7th, or morning of the 8th, the highest reported being 30·658 in. at 9 p.m. on the 7th at Ramsgate; the minimum took place on the 15th, 27th, and 30th, the lowest being 29·377 in. at 9 p.m. on the 30th at Scaleby.

AIR TEMPERATURE was much below the average for the quarter.

In *January* the mean* was 31°·0; it varied from 35°·8 at Babbacombe to 28°·0 at Buxton. With the exception of the 1st, 3rd, 13th, 14th, and 15th, the weather was very cold throughout the month. The maximum temperature was registered at nearly all the stations on the 1st, the highest being 56°·4 at Scaleby; the minimum occurred generally on the 11th or 12th, the lowest being 7°·0 at Hillington on the 11th. The mean daily range was 8°·6.

In *February* the mean temperature was 36°·7, and varied from 40°·7 at Babbacombe to 33°·4 at Buxton, and 33°·8 at Scaleby. The weather was cold from the 1st to the 5th, mild from the 6th to the 15th, and cold for the remainder of the month. The maximum temperatures occurred on the 8th, 9th, or 10th, the highest registered being 54°·9 at Hillington, and 54°·8 at Cheltenham on the 9th; the minimum took place on the 24th in the SE, and on the 25th in the N and W, the lowest temperature reported being 12°·4 at Cheltenham on the 25th. The mean daily range was 8°·9.

In *March* the mean temperature was 38°·9, and varied from 41°·8 at Llandudno to 36°·7 at Buxton. The weather was changeable, short periods of cold and mild weather alternating with each other, the period from the 22nd to the 28th being very cold. The maximum temperatures occurred generally on the 9th and 19th, the highest registered being 65°·2 at Croydon on the latter date; the minimum took place on the 13th and 14th in the W and N, and on various dates at other places, the lowest recorded being 18°·2 at Scaleby on the 14th. The mean daily range was 13°·0.

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* The mean of the 9 a.m. and 9 p.m. dry bulb readings.

The RAINFALL at several stations was excessive.

In *January* it was large in the SW, but small in the N, the quantities varying from 9·54 in. at Dartmoor to 0·82 in. at Llandudno. The greatest daily falls occurred on the 1st in the S and SE, and on the 12th, 14th, and 17th in the other districts; the heaviest recorded amount was 1·68 in. at Eastbourne on the 1st. Snow fell on several days at all the stations.

In *February* the weather was rainy at all the stations. The falls varied from 10·32 in. at Dartmoor, where rain fell every day, to 2·27 in. at Hillington. The heaviest fall was 1·70 in. at Dartmoor on the 8th. Snow fell at all the stations during the month, and was very general on the 1st, and from the 17th to the 25th.

In *March* the rainfall was below the average, although the number of rainy days was comparatively large, the falls generally being slight. The total depth varied from 3·02 in. at Dartmoor, and 2·75 in. at Carmarthen, to 0·48 in. at Strathfield Turgiss. The heaviest fall was 0·75 in. at Dartmoor on the 26th. Snow fell generally on the 14th, and from the 22nd to the 27th. Thunderstorms occurred at several places on the 30th and 31st.

FOG was especially prevalent in February.

WIND.—In *January* the wind blew generally from the E and NE, and was strong in force, especially in the SW, where gales were experienced on several occasions. In *February* the general direction was SE from the 1st to the 4th, SW from the 5th to the 20th, and N from the 21st to the end of the month. The force was moderate, gales occurring only at a few places. In *March* SW winds prevailed from the 1st to the 17th, NE from the 18th to the 28th, and SW during the last three days of the month. The force was strong throughout the month, and gales occurred at several places, especially in the N.

NOTES BY THE OBSERVERS.

AUDLEY END, *January*.—The mean daily temperature was 10°·0 below the mean for the previous eleven years. Neither sun nor blue sky were seen for the eleven days ending February 3rd.

BABBACOMBE, *January*.—It has been the coldest month of this severe winter. The maximum temperature was especially low, averaging only 39°·8, and being below 32°·0 on four days, viz. 11th, 22nd, 23rd, 24th. The temperature and pressure oscillated considerably till the 19th, but were afterwards steady, the range of the thermometer being only 10°·4 in the last ten days, which were very overcast and gloomy. A remarkable rise of temperature, of 22°·4, occurred between 9 a.m. 12th (25°·5) and 9 a.m. 13th (47°·9), occasioned by the setting in of a warm SW wind after a cold N one. Snow fell on 9 days, but only covered the ground 0·2 in. deep on the 11th and

12th. The greater part of the rainfall (6·00 in.) fell in the first 17 days, after which the weather was generally dry.

February.—The weather was warm from the 5th to the 14th, cold with snow and hail showers from the 17th to the 26th, during which time Dartmoor was covered with snow, although it did not lie on the ground here.

March was generally mild till the 21st, and also on the last three days, but cold and gloomy from the 22nd to the 27th, with strong ENE winds. Fine bright weather prevailed from the 6th to the 11th.

BOURNEMOUTH.—The total duration of sunshine was in January 22·7 hours; February 45·5 hours; and March 99·7 hours.

CHELTENHAM, *January.*—The ice "bore" from the 6th to the 11th, and from the 21st till the end of the month. After the 23rd the sun was not at any time visible, and the thermometers kept with remarkable regularity a few degrees below freezing point, little variation being observed between the two maximum and two minimum instruments.

February.—Snow fell on the 24th to the depth of 3 in.

March.—Apricot trees just coming into blossom on 31st, peach and nectarine buds swelling, but not colouring.

CROYDON, *January.*—Remarkable for a long continuance of low temperatures, NE winds, its dry atmosphere, and frequent falls of snow. The temperature over grass on 30 successive nights (2nd-31st) fell to or below 32°. The first frost of the month penetrated an exposed flower-border to the depth of 8½ in., and the second to 7¾ in. The only points of the compass from which the wind blew during the last 15 days were between N and SE. At no time was the snow more than 1 in. deep, though for 9 consecutive days (18th to 27th) it covered the ground to the depth of at least ½ in.

February.—A heavy fall of frozen rain on the 1st, and a short but very dense fog on the 17th. Between the morning of the 5th and the evening of the 11th, the temperature of the soil at the depth of 1 foot had risen 10°. A double snowdrop came into blossom under a south wall on the 11th.

March.—A yellow crocus came into blossom in an exposed border on the 3rd, and a double snowdrop on the 6th. An early apricot came into bloom on a south wall on the 21st—17 days later than last year.

DARTMOOR, *February.*—The wildest winter on Dartmoor for 20 years.

DOWNSIDE, *February.*—Currants in leaf-bud on the 3rd.

HILLINGTON, *January.*—The sun shone on 5 days only; and from the 17th to the end of the month (22nd excepted) was invisible. The snow was usually of exceptional lightness.

February.—The snowfall was slight; never sufficiently deep to be measured.

NORWOOD, *January 10th.*—Parhelion (pillar and cross) observed in the West of London from 9 to 10 a.m.

February 21st.—Heavy snow 5 to 10 a.m., which covered the ground to the depth of 3 in.

March 4th.—Mock suns 9 to 10 a.m. 19th.—Mock suns in afternoon.

Abstract of Meteorological Observations for the Month of JANUARY, 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Total Fall.	Greatest Fall in 24 hours.		Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
					Min.	Max.	Min.	Date.	Max.	Date.								Amnt.	Date.														
	In.	°	°	°	°	°	°		°			°	o/o	o/o			In.	In.															
Scaleby	30·028	27·9	29·2	28·6	24·2	35·6	13·0	23	56·4	1	27·4	28·4	90	86	5·2	4·9	1·54	1·10	12	7	9	7	7	2	3	11	15	4	0	4	3	0	22
Gainford	·045	28·9	29·4	29·2	24·3	35·2	9·8	27	49·2	1	28·1	28·7	86	88	5·5	6·4	·95	·26	12	9	14	6	13	1	5	4	3	12	2	5	5	11	15
Wakefield	·071	30·8	31·5	31·2	26·5	35·8	13·7	4	49·7	1	30·0	30·7	88	89	7·2	7·4	1·30	·38	14	9	3	1	15	0	8	10	16	4	3	1	10	7	3
Kelstern	·075	30·4	29·6	30·0	27·2	34·1	18·9	4	47·5	1	29·2	28·7	82	85	7·6	6·8	1·29	·70	14	11	10	2	16	0	7	8	21	7	2	3	4	8	2
Mansfield	·082	28·9	28·2	28·6	24·5	34·1	8·8	11	49·4	1	27·9	..	82	..	8·0	6·5	1·64	·43	14	10	14	2	15	0	1	9	12	4	2	8	5	3	18
Buxton	·084	27·9	28·0	28·0	23·3	32·7	10·0	11	45·4	1	27·0	27·0	82	79	7·6	6·8	2·43	·79	14	8	6	2	14	0	2	7	17	16	2	3	1	9	5
Cheadle	·067	28·6	29·0	28·8	25·6	33·4	17·3	11	48·1	1	27·8	28·4	85	89	8·0	6·8	2·24	·59	14	6	11	2	17	4	6	9	23	10	4	0	2	3	5
Llandudno	·038	33·7	33·3	33·5	30·2	37·7	19·1	11	50·0	14	32·1	31·8	83	84	6·7	5·4	·82	·26	17	9	4	4	13	1	0	5	21	15	8	1	7	5	0
Chester	·040	29·9	30·4	30·2	25·9	35·8	9·5	11	50·0	1, 13	28·8	29·2	83	81	..	..	1·55	·40	17	7	4	.	..	2	4	6	12	15	13	4	0	1	7
Shrewsbury (Leaton)	·062	28·1	29·0	28·6	24·2	34·1	9·4	12	49·0	1, 13	27·7	28·4	93	89	..	..	1·47	·51	17	10	7	..	..	..	0	4	17	17	5	3	9	1	6
Churchstoke	·074	28·3	29·5	28·9	24·4	33·8	12·8	11	49·1	1	27·3	28·7	81	86	7·2	8·0	1·48	·51	2	11	9	0	15	0	4	10	23	8	4	5	7	1	0
Cheltenham	·042	31·1	30·8	31·0	26·1	35·4	12·8	12	50·1	1	30·7	30·4	95	94	7·8	6·9	2·51	·94	1	13	9	4	18	2	3	13	18	12	3	3	4	5	1
Carmarthen	30·009	32·9	32·2	32·6	28·4	38·8	14·1	11	52·9	1	32·2	31·7	92	94	6·8	7·2	3·53	·66	12	10	4	4	18	0	7	6	27	6	0	1	1	4	10
Dartmoor	29·970	30·0	30·3	30·2	26·9	34·7	15·0	11, 12	46·6	3	29·8	30·1	96	96	8·4	7·3	9·54	1·54	2	15	6	1	20	11	3	8	29	4	3	3	1	2	9
Babbacombe	29·981	35·9	35·7	35·8	32·6	39·8	19·1	12	52·8	13	34·3	34·2	85	86	8·4	7·6	6·35	1·46	1	15	9	2	20	12	6	17	17	6	3	6	4	2	1
Downside	30·020	30·4	30·2	30·3	27·1	35·2	16·7	11	48·8	1	29·8	29·8	90	94	8·8	7·3	4·40	1·23	1	10	6	1	20	5	1	28	7	9	1	9	4	3	0
Marlborough	·045	29·8	29·6	29·7	26·5	35·4	14·7	12	49·0	1	29·1	28·9	87	88	8·3	7·5	4·02	1·46	1	12	8	2	20	0	1	22	15	0	2	2	1	2	17
Strathfield Turgiss	·037	32·1	30·5	31·3	26·6	35·9	15·1	11	50·1	1	30·7	29·2	83	81	8·1	8·2	3·43	1·40	1	9	7	2	22	0	3	22	7	13	1	3	3	3	7
Norwood	·035	32·0	31·1	31·6	28·5	35·0	19·1	12	50·2	1	30·8	30·0	85	84	7·8	6·7	2·40	1·11	1	12	9	5	18	1	2	14	21	3	2	5	7	4	4
Croydon	·035	31·7	30·9	31·3	28·0	35·6	18·3	11	50·9	1	30·6	29·8	85	84	8·2	7·5	2·61	1·12	1	11	15	4	21	0	1	24	11	3	3	4	6	1	9
Bournemouth	·005	33·4	33·8	33·6	30·6	37·9	16·0	12	50·0	3	32·0	32·4	85	86	7·7	6·7	4·14	1·37	1	14	6	2	18	2	5	15	21	5	2	5	3	6	0
Eastbourne	·012	34·6	34·1	34·4	31·2	38·1	22·9	11	52·3	1	33·5	33·0	89	89	8·5	7·5	3·95	1·68	1	10	3	2	22	2	7	16	17	1	0	2	9	9	1
Ramsgate	·052	33·3	33·4	33·4	30·3	37·3	21·6	12	50·3	1	32·3	32·1	89	86	8·2	7·5	2·22	1·05	1	9	3	1	19	3	4	29	5	0	1	5	7	3	8
Audley End	·021	30·7	30·0	30·4	25·8	34·8	15·0	6	51·4	1	29·7	29·2	85	87	8·0	6·9	2·14	·80	1	11	14	3	18	0	0	36	0	8	0	4	1	10	3
Hillington	·051	31·2	30·3	30·8	26·3	35·2	7·0	11	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	8·1	8·0	1·15	·46	2	11	16	2	20	0	1	15	12	18	2	5	3	6	0

Scaleby	...	...	...	...	...	...	...	...	*	*	*	●*	●*	●	●	...	●	●*	...	...	...	*	...	*	...	...	...	...	●*	...	...
Gainford	...	...	...	ɯ	...	...	...	▲*	*	●*	●*	●*≡	...	●	...	...	●*	*	...	...	●*	*	●*	*	...	...	...	...	*	●*	●*
Wakefield	ɯ	●	●*	...	...	...	...	...	...	...	●	●	●*	●	...	≡	●	●*	...	...	...	...	...	...	...	...	...	...	...	...	●
Kelstern	○	●	●*≡	...	...	≡	ɯ	...	●*▲	●*▲	●*	●*○	●≡	●≡	...	...	...	●*	...	...	●*	...	*	...	...	...	...	*≡	●*	...	...
Mansfield	...	*	●*	●≡	...	...	...	...	...	*	●*	●*	●*	●≡	...	≡	●≡	●*	...	...	*	*	●*	*	...	...	...	*≡	●*	*	...
Buxton	...	●	●*	...	...	≡	...	...	...	...	...	●*	●	●≡	...	...	...	●*	..	...	●*	*	...	≡	...	...	...	...	...	●*	...
Cheadle	...	●*≡	*	≡	≡	...	≡	...	...	*	*	●*	●≡	●≡	...	...	●	●*	...	...	...	*	*	*	...	...	...	≡	*	*	...
Llandudno	...	●	*≡	●▲	...	●*	●*	...	...	...	*	●	●	●	●	...	●	≡	...	...	...	...	...	...	...	...	≡	≡	...	≡	≡
Chester	...	●	*	...	...	≡	*	...	...	...	≡	●*	●≡	●≡	≡	≡	●≡	●	...	...	...	...	...	...	...	...	...	≡	≡	●*	...
Shrewsbury (Leaton)	...	●	●*	●	...	●	●*	*	...	*	●*	●*	≡	●	...	...	●	●*	...	...	...	...	...	...	...	...	...	...	...	...	...
Churchstoke	●*	●	●*≡ɯ	●*≡	...	●≡	●*≡	*	...	*	*≡	●*	≡	●≡	...	●	●≡	*≡	≡	...	≡	...	≡	≡	≡	≡	≡	≡	≡	≡	●≡
Cheltenham	●*	●*ɯ	*≡	...	...	●*≡	●*≡	...	...	●*	●*	●*	●≡	●≡	●	...	●≡	●≡	...	...	...	...	...	...	...	*	...	...	...	...	●
Carmarthen	●*	●	●	...	...	●	●*	*	...	...	...	●	●≡	●	...	...	●	...	...	*	...	...	..	...	...	...	...	...	...	...	●
Dartmoor	●≡	●*≡	≡	...	...	●	●*▲≡	*	...	●*	...	●≡	●≡	●≡	●	●	●≡	...	●≡	...	...	...	...	...	...	≡	●≡	●*	≡	...	●*≡
Babbacombe	●≡	●○	●	...	○ɯ	●*▲	●*▲	...	...	●*	*	●	●≡	●≡	●	●	●	...	...	...	...	...	...	*	*	●*	●	*	...	...	●*
Downside	●*	●	*	*	...	●	●*	...	...	...	...	●	●	●	...	...	●≡	...	...	...	...	...	...	...	*	●	≡	...	...	...	●*
Marlborough	●*	●≡	●*≡	...	..	●	●*≡	...	*	*	*	●*	●	●	...	...	●≡	●*	...	...	...	...	...	...	..	...	●	...	...	...	●
Strathfield Turgiss	●*	●ɯ	●*≡	≡	...	●≡	*≡	...	≡	...	*≡	●	●≡	●≡	...	...	●≡	●*▲≡	...	...	...	...	...	...	...	...	...	...	*	*≡	≡
Norwood	●*≡	●ɯ	●≡	...	≡	≡	●≡	...	*	...	●*	●*	●≡	●	●	≡	●≡	●*	*	*	...	...	...	*	...	...	...	...	...	●*	...
Croydon	●*▲	●*▲ɯ	●	...	...	≡	...	...	*	...	*	●*	●	●	●	●	●≡	●*	*	...	*	...	...	*	*	●*≡	...	*	*	*▲	*
Bournemouth	●	●	●	...	...	●	●*	...	...	*	...	●	●≡	●	...	●	●	...	...	...	...	...	...	●*	●*	●*	...	...	...	...	●*
Eastbourne	●	●	●	...	...	≡	...	...	...	...	...	●	●≡	●≡	...	...	●	●*	...	...	...	...	...	●*	●*	...	...	...	...	...	...
Ramsgate	●	●ɯ	●	▲	...	...	...	...	▲	*	*	●	●	●≡	●≡	●≡	≡	●*	..	...	...	...	...	▲	▲	...	≡	≡	▲	▲	▲
Andley End	●*○	●*	●*	*	...	ɯ	...	...	*	●*	●*	●*	●≡	●≡	...	...	...	●*	...	...	...	...	...	●	*	●*	...	*	*	*	...
Hillington	●*	●*ɯ	●*	...	...	...	...	...	●*	●*	●*	●*	●*≡	●	...	...	...	●	*	...	*	*	*	...	●*	*	...	*	*	..	...
Lowestoft	●*	●	●	...	...	...	...	●	...	●*	●*	●	●≡	●≡	...	...	...	...	...	●	...	...	...	...	...	...	●	●	...	...	...

EXPLANATION OF THE SYMBOLS.—● indicates rain; * snow; ▲ hail; ≡ fog; K thunderstorm; ⊤ thunder; ⩽ lightning; ○ solar halo; ɯ lunar halo.

Abstract of Meteorological Observations for the Month of February, 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
					Means of		Absolute Min. and Max.										Total Fall.	Greatest Fall in 24 hours.															
		9 a.m.	9 p.m.	Mean.	Min.	Max.	Min.	Date.	Max.	Date.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.		Amnt.	Date.	Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	29·480	33·4	34·3	33·8	30·3	39·2	20·2	25	46·2	6	33·1	33·8	96	94	8·2	7·1	2·78	·56	6	21	7	2	15	1	3	8	10	5	2	4	2	1	21
Gainford	·521	34·4	33·9	34·1	32·9	39·4	18·8	25	49·7	27	33·5	33·0	91	90	8·7	8·0	3·69	·45	12	25	19	0	19	0	5	12	6	4	0	8	1	9	11
Wakefield	·533	36·2	36·1	36·1	32·7	40·2	24·7	25	53·1	9	35·4	35·2	92	92	9·2	8·5	2·50	·50	8	21	7	0	20	1	8	7	10	7	3	6	9	5	1
Kelstern	·541	34·6	33·2	33·9	30·1	38·5	18·1	24	52·4	9	33·9	32·9	93	97	8·8	7·4	3·07	·66	8	23	11	1	19	0	7	5	8	8	9	6	4	8	1
Mansfield	·537	34·9	34·7	34·8	31·8	40·0	19·0	24	52·1	9	34·3	33·8	94	91	8·9	7·8	3·01	·54	13	20	11	1	19	0	7	6	5	2	6	8	3	1	18
Buxton	·553	34·2	32·6	33·4	28·6	37·3	13·8	22	47·1	10	33·4	31·6	92	88	9·6	8·1	4·73	·67	7	21	11	0	19	0	4	6	10	7	0	8	5	13	3
Cheadle	·529	34·3	34·2	34·3	31·0	39·0	21·9	24	53·0	9	33·8	33·7	94	94	9·5	7·3	4·09	·72	8	20	10	0	18	5	9	3	10	3	6	9	4	9	3
Llandudno	·503	39·2	38·5	38·9	35·2	43·1	28·2	1	50·8	10	37·3	37·1	85	88	7·8	7·3	3·19	·78	15	16	7	0	13	2	2	7	6	11	5	5	16	4	0
Chester	·503	36·9	36·9	36·9	33·3	42·3	26·3	2	52·0	9	35·8	35·6	90	88	..	..	2·36	·33	8	19	8	..	..	1	12	2	1	6	14	5	2	8	6
Shrewsbury (Leaton)	·533	36·0	36·1	36·0	31·2	41·6	21·0	25	54·2	27	35·2	35·4	92	93	..	..	2·76	1·15	8	20	9	..	..	..	5	3	3	6	0	6	9	3	21
Churchstoke	·540	36·2	36·4	36·3	31·9	42·0	20·3	25	52·4	9	35·2	35·6	90	93	8·0	8·0	2·74	·39	8	19	9	0	14	0	5	6	10	5	6	5	15	4	0
Cheltenham	·534	38·0	37·5	37·7	32·6	42·8	12·4	25	54·8	9	37·0	36·6	91	92	8·7	6·5	2·70	·38	13	23	9	2	15	0	5	2	3	15	6	9	1	13	2
Carmarthen	·514	40·0	38·9	39·4	34·7	45·7	24·2	25	52·2	11	39·0	38·1	91	93	7·4	7·3	4·94	·89	8	22	4	1	14	0	10	1	7	8	3	9	5	3	10
Dartmoor	·539	36·5	36·1	36·3	32·2	40·4	20·7	25	48·0	14	36·2	35·8	97	97	8·7	7·8	10·32	1·70	8	28	11	0	20	0	3	7	3	6	3	7	8	9	10
Babbacombe	·541	41·0	40·3	40·7	36·8	46·7	28·2	25	53·9	6	39·6	39·2	88	91	7·4	7·4	5·49	·93	1	24	10	0	13	8	8	5	6	3	6	15	7	4	2
Downside	·540	36·8	37·2	37·0	32·9	42·4	20·3	25	50·4	8	36·4	36·8	96	96	8·3	7·3	5·91	·75	10	24	10	0	16	1	5	7	3	7	4	18	6	6	0
Marlborough	·556	36·0	36·7	36 4	32·8	43·4	20·9	22	52·7	9	35·3	36·1	93	94	8·9	7·9	4·74	·65	8	23	7	0	20	0	4	3	2	3	1	11	4	2	26
Strathfield Turgiss	·553	37·7	37·7	37·7	33·0	43·4	16·6	24	52·1	8, 9	36·3	36·5	88	89	8·5	7·8	3·20	·41	8	24	9	2	19	0	8	4	2	7	5	15	6	6	3
Norwood	·548	37·0	38·3	37·6	34·2	42·7	17·1	24	52·8	9	36·0	37·2	91	90	8·5	8·7	3·58	·72	10	23	12	1	18	5	5	7	6	5	4	6	13	6	4
Croydon	·552	37·2	37·9	37·6	34·4	42·8	20·9	24	52·7	9	36·1	36·8	90	90	9·1	7·8	3·45	·53	10	23	13	1	19	0	5	6	5	6	5	15	6	1	7
Bournemouth	·520	38·3	38·8	38·6	35·8	42·9	27·0	23	48·0	8	37·2	37·8	90	92	6·7	5·8	3·92	·48	13	25	5	2	10	0	5	8	8	7	4	10	11	3	0
Eastbourne	·550	38·8	39·6	39·2	36·2	43·2	26·7	24	53·0	9	37·7	38·7	91	93	7·9	8·6	3·98	·92	9	21	8	1	18	0	4	7	7	4	1	5	11	16	1
Ramsgate	·581	37·8	38·5	38·1	34·7	42·7	26·9	1	52·6	8	36·8	37·5	91	91	9·1	8·8	3·22	·43	16	23	8	0	19	2	5	15	2	2	6	14	4	1	7
Audley End	·502	37·0	37·3	37·1	33·4	41·6	20·0	24	53·6	9	36·0	36·3	91	91	8·5	8·0	3·32	·72	10	26	14	1	21	0	1	10	2	11	0	15	3	14	0
Hillington	·528	36·8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	10	3	13	8	12	1	7	0

Scaleby	●	●✱	●	...	●▲	●	●	●	●	●	...	...	●	●	●	●	●	●✱	●✱	...	...	●✱	●✱	●✱	...	●✱	●☰	...
Gainford ..	●✱	●✱☰	●✱☰	●✱☰	●☰	●✱	●✱	●✱	●	...	...	●	...	●✱	●✱	●✱	●✱☰	●✱	●✱	●✱	●✱	●✱	●✱	●✱	●✱	●	●	●
Wakefield ..	●	●✱	●	...	●	●Ψ	●	●	●	☰	...	...	●	●	●	...	●	●✱	●✱	●✱	●✱	●	●✱	✱	●	●	...	●
Kelstern	●	●✱☰	●☰	✱	●✱☰	●	●	●☰	●	●☰	☰	...	●	●☰	●☰	●✱☰	●☰	●✱	●✱	●✱	●✱	...	●✱	☰	●✱▲	●✱	●☰	●☰
Mansfield ..	●✱	●✱☰	☰	...	●✱	●	●	●	●	●	☰	...	●	●☰	●✱	●	☰	●✱	●✱▲	●✱	●✱▲	●	●✱	✱	●✱	...	☰	●☰
Buxton	✱	●	●☰	✱	●✱▲	●	●	●	●	...	...	...	●	●☰	●	●✱	●✱☰	●✱☰	●✱	●✱	●✱	...	●✱	...	●✱	●	●▲	●
Cheadle	●✱	●☰	☰	...	●✱	●	●	●	●	...	☰	...	●☰	●☰	●☰	●	●✱	●✱☰	●✱	●✱	✱	●	●✱☰	✱☰	✱	●☰	●☰	●☰
Llandudno ..	●✱☰	✱☰	☰	☰	●	●	●☰	●	...	●☰	...	...	●☰	☰	●	●✱	●✱	●✱	●✱	●✱	☰	...	●	▲	...	...	●	●
Chester	●✱	●	...	☰	●	●	●	●	●	...	▲	...	●☰	...	●	●	●✱☰	●✱▲	●✱	●✱☰	✱☰	●	●✱	✱▲	...	●	●☰	●
Shrewsbury	...	●	●	...	●	●Ψ	●	●	●	☰	☰	☰	●☰	●☰	●☰	●	●✱	●✱	●✱	●✱☰	●✱	●✱	●✱	✱	...	✱	●	●
Churchstoke	●✱	●☰	☰	☰	●✱☰	●☰	●☰	●	●☰	☰	☰	●☰	●☰	●☰	●☰	...	●✱▲☰	●✱☰	●▲☰	✱	✱☰	●	●✱	●✱☰	✱	☰	●	●☰
Cheltenham	●✱	●✱	●	...	●	●	●	●	●	●	●	●	●	●	●	●	●	●✱	●✱	✱	...	✱	●✱	●✱	✱	●	●☰	●
Carmarthen	●✱▲	●	...	●	●	●	●	●	●	●	...	●	●	●	●▲	●ꓘ	●▲	●▲	●✱	●✱<	✱	●	●	...	...	●	●☰	...
Dartmoor ..	●✱☰	●☰	●☰	●☰	●☰	●☰	●☰	●☰	●☰	●☰	●☰	●☰	●☰	●☰	●☰	●▲☰	●✱▲☰	●✱☰	●✱☰	●✱☰	●✱☰	●✱☰	●✱☰	●✱☰	●✱☰	●✱☰	●☰	●☰
Babbacombe	●✱	●☰	●☰	...	●	●Ψ	●	●○	●☰	●☰	●	●	●	☰	●☰	●	●✱▲	●✱	●✱▲	●✱▲<	●✱	●✱	●✱▲	✱▲	✱	●	●	●☰
Downside ..	●✱	●☰	●☰	...	●☰	●Ψ	●	●	●	●☰	●	...	●	●	●☰	●	●	●✱	●✱	●✱▲	●✱	●✱	●✱	✱	✱	●✱	●	●
Marlborough	●✱	●☰	●	...	●✱☰	●	●	●	●	●☰	●	...	●	●	●☰	●▲	●✱	●✱	●	●✱	✱	✱	●	☰	●	●	●☰	●☰
Strathfield T.	●✱▲	●▲☰	●✱☰	✱☰	●✱	●	●	●	●	●☰	●	☰	●☰	●☰	●☰	●	●✱	●	●	●✱	●✱☰	☰	●✱	☰	✱	●	●☰	●☰
Norwood	●✱▲	●▲☰	●✱☰	✱	●	●○	●	●	●	●	●	...	●	...	●	●▲	●✱☰	●✱	●✱	●✱▲	●✱	✱☰	●✱☰	☰	●✱▲	●	●✱☰	●
Croydon	●✱▲	●☰	●✱	✱	●	●	●	●	●	●	●	...	●☰	...	●	●	●✱☰	●✱▲	●✱	●✱▲	●✱	✱	●✱	...	●✱	●✱	●✱	●
Bournemouth	●	●	●	...	●	●	●	●	●☰	●☰	●	●	●	●	●	●	●	●	●✱	●✱	●✱	●✱	●✱	...	...	●	●☰	●
Eastbourne	●✱	●☰	●	●	●	●Ψ	●	●	●	●	●	...	●	...	●	●	●	...	●	●✱▲<	●✱▲	...	●✱	✱	✱	✱	●✱	●☰
Ramsgate ..	...	●☰	●☰	●✱	●✱	●	●	●	●	●	...	...	●	●	●	●	●✱	●	●	●✱	✱	●▲	✱	●▲	●✱▲	●✱▲	●	●☰
Audley End	●✱	●✱☰	●☰	...	●✱	●	●	●	●	●	●	●	●	●	●▲	●✱	●✱	●✱	●✱	●✱	●✱	●✱	●✱	...	●✱	●✱	●✱	●☰
Hillington ..	●	✱	...	✱Ψ	●	...	●	●	●	●	●	...	●	●	●✱	●✱	...	●✱▲	●✱	●✱	✱	●✱	●✱	●✱	●✱	●✱	●✱	●☰
Lowestoft ..	☰	●☰	●☰	...	●	●	...	●	●	●☰	...	●	●	●	●	●✱	●✱	●	●	...	●✱▲	...	...	●	●✱	...	●	●

EXPLANATION OF THE SYMBOLS.—● indicates rain; ✱ snow; ▲ hail; ☰ fog; ꓘ thunderstorm; T thunder; < lightning; ○ solar halo; Ψ lunar halo.

Abstract of Meteorological Observations for the Month of March, 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Total Fall.	Greatest Fall in 24 hours.		Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
					Min.	Max.	Min.	Date.	Max.	Date.								Amnt.	Date.														
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	29·905	38·1	37·6	37·9	32·8	44·7	18·2	14	53·9	30	36·8	36·3	89	88	7·2	6·8	1·95	·39	18	19	9	2	14	6	1	8	14	1	1	19	2	1	15
Gainford	·963	38·9	37·1	38·0	33·0	45·5	20·5	14	57·9	19	36·7	35·5	82	86	7·5	6·3	1·18	·39	13	14	10	2	13	2	1	23	1	5	2	16	5	5	4
Wakefield	·971	39·5	39·0	39·3	34·4	46·2	24·6	13	56·3	8	38·2	37·6	89	88	7·5	6·6	1·09	·27	17	12	6	2	13	3	6	8	9	5	4	8	19	3	0
Kelstern	·985	38·0	36·5	37·3	32·9	44·9	25·6	13	58·8	9	36·7	35·2	89	88	6·8	6·6	1·09	·19	28	17	8	5	17	1	6	8	10	4	7	12	7	7	1
Mansfield	29·983	38·2	37·0	37·6	34·0	46·4	26·8	13	57·5	9	36·5	35·7	85	88	7·3	5·2	·97	·27	26	15	9	6	13	0	8	6	10	1	5	14	10	1	7
Buxton	30·002	37·2	36·3	36·7	31·5	43·7	24·0	13	56·4	9	35·8	34·0	87	87	8·2	6·5	2·74	·68	16	15	9	3	15	0	1	1	15	7	0	10	9	15	4
Cheadle	29·983	37·6	37·2	37·4	32·6	45·3	24·9	13	56·6	19	36·4	35·8	89	88	7·5	5·4	1·10	·30	16	15	6	6	14	10	4	4	15	4	6	8	7	9	5
Llandudno	·949	42·7	41·0	41·8	37·4	46·3	28·0	26	54·8	8	40·0	38·7	80	82	6·7	6·1	1·47	·32	16	12	5	3	14	4	3	4	18	2	4	7	21	3	0
Chester	·958	40·8	39·7	40·2	34·4	48·1	25·3	13	57·2	19	38·4	37·6	81	83	..	..	·95	·28	16	14	4	..	..	7	4	1	11	5	9	9	10	5	8
Shrewsbury (Leaton)	29·990	39·8	38·1	39·0	33·1	47·1	20·0	13	57·3	12	38·0	36·6	85	87	6·1	5·1	1·04	·39	17	16	5	8	10	0	3	4	12	6	2	8	21	1	5
Churchstoke	30·000	39·1	38·7	38·9	33·2	46·2	22·3	13	56·4	7	37·7	37·2	88	87	7·3	7·0	1·30	·35	17	15	4	0	12	2	9	9	6	3	5	23	7	0	0
Cheltenham	29·992	40·5	39·3	39·9	32·8	48·2	23·0	2	59·8	19	39·1	37·9	88	89	7·6	6·9	·98	·22	30	14	4	2	16	0	6	6	10	4	9	12	9	6	0
Carmarthen	·975	42·1	40·1	41·1	35·6	50·7	24·7	2	61·9	19	40·3	38·8	86	89	6·8	5·6	2·75	·63	17	15	1	6	12	0	8	1	14	5	1	13	6	2	12
Dartmoor	·980	37·9	36·0	36·9	32·7	46·4	23·4	25	54·4	9,19	36·8	35·6	90	96	6·3	5·4	3·02	·75	26	16	5	4	9	0	4	9	12	3	2	7	12	7	6
Babbacombe	·990	42·6	40·8	41·7	36·5	48·9	26·2	14	56·6	16,29	40·4	39·4	83	88	6·7	6·1	·56	·18	28	13	3	5	13	6	6	16	6	0	3	19	6	5	1
Downside	29·991	38·7	38·6	38·7	34·5	46·9	27·8	24,25,26	59·8	19	37·9	37·5	93	91	7·0	5·8	1·58	·35	31	17	5	5	13	2	1	20	0	5	2	23	5	6	0
Marlborough	30·009	39·5	38·7	39·1	33·9	48·1	27·3	2	62·5	19	37·9	37·5	87	90	6·9	7·0	·94	·23	30	15	5	5	18	0	3	13	2	2	0	16	2	2	22
Strathfield Turgiss	30·001	41·6	39·6	40·6	33·7	49·0	26·8	9	63·5	19	39·2	37·5	81	83	7·6	6·5	·48	·13	29	9	6	5	18	0	3	14	2	5	4	12	12	8	2
Norwood	29·992	40·6	40·2	40·4	35·0	48·8	27·8	8	64·2	19	38·6	38·3	84	84	6·8	5·8	·64	·10	14	13	6	6	12	1	7	10	8	1	3	9	13	3	8
Croydon	·998	40·4	39·7	40·0	35·0	48·8	28·6	8	65·2	19	38·5	37·9	85	85	6·5	5·6	·56	·12	14	12	7	6	12	0	4	15	3	1	7	19	5	1	7
Bournemouth	·959	41·1	40·6	40·8	36·4	47·0	30·0	25	56·5	19	39·2	39·1	85	88	5·4	5·0	·62	·19	30	10	0	9	11	0	8	14	6	3	0	15	5	10	1
Eastbourne	29·991	41·5	40·6	41·0	35·8	47·5	30·1	25	58·8	9	39·6	39·1	85	88	6·7	5·1	1·14	·43	31	9	3	5	11	1	2	17	9	2	0	12	11	8	1
Ramsgate	30·032	41·3	40·2	40·8	36·0	48·0	29·6	24	61·2	9	39·6	38·9	86	89	6·6	5·7	·70	·13	11, 28	9	4	5	11	1	1	16	5	0	2	17	5	6	10
AudleyEnd	29·965	40·0	38·6	39·3	33·2	48·0	26·0	8	64·0	19	38·1	37·1	84	87	6·9	6·4	·91	·19	30	18	7	3	14	0	0	16	0	8	3	19	1	14	1
Hillington	·969	40·5	38·0	39·3	33·3	47·5	26·5	2	64·1	19	38·9	36·5	87	87	7·7	7·1	·74	·11	28	15	7	3	18	3	3	7	13	7	2	21	3	5	1
Lowestoft	29·977	40·2	38·8	39·5	34·1	45·9	27·3	14	61·7	9	38·0	37·0	82	85	7·1	5·9	1·22	·24	13, 18	12	3	6	14	2	6	3	14	3	7	6	19	3	1
Columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Scaleby	...	●	●	●	●	●	...	≡	...	●	●	...	●*	●*	●	...	●*	●	...	...	...	...	...	●*	●*	●*	●*	●*	*	●	●
Gainford	...	●Ψ	...	...	●	...	...	●	...	...	●	●	●*	●*	●*	●*	*	≡	●≡	≡	≡	●	●	*	●*	●*	*	*	...	...	...
Wakefield	Ψ	...	...	Ψ	●	...	Ψ	Ψ	...	...	...	●Ψ	●	●*	●*	*	●	...	...	...	●	...	...	...	●*	●*	●*	●	...	●☇	...
Kelstern	...	●	Ψ	...	●	...	...	...	...	●	...	...	●*	●*	●*	●≡	●	●≡	≡	≡	●*≡	*	...	...	●	●*	●*	●*	●	●	●
Mansfield	...	●	*	...	●	...	...	...	...	...	...	...	●	●*	●	●	●*	...	●≡	≡	●*	...	...	*	●*	●*	●*	●*	●	Ψ	●▲
Buxton	...	●	...	...	●	..	...	...	●	●	●	●*	●	*	●	●*	●	●≡	≡	...	●	*	...	*	*	●*	*	●*	...	●T	...
Cheadle	...	●	...	...	●	...	...	▲	...	●	...	...	●	●*	●	●	●*	●≡	≡	...	≡	...	...	*	●*	●*	*	●	●	●T	●▲
Llandudno	...	●	...	...	●	...	≡	≡	...	●	...	...	●	...	●	●≡	●*	●	≡	≡	...	...	...	*	*	●*	●*	●	●	...	...
Chester	...	●	...	...	●	...	...	≡	...	●≡	...	...	●	●*	●	●	●	●	≡	≡	...	...	...	*	...	●*	●*	●	...	●	●
Shrewsbury (Leaton)	...	●	...	...	●	...	●	≡	...	≡	...	...	●	*≡	●	●	●	●	●≡	≡	...	...	...	*	●*	●*	●*	●	●	●Ψ	●
Churchstoke	...	●	≡	...	●	≡	...	...	...	●≡	...	...	●	●*≡	●≡	●≡	●≡	●≡	≡	≡	≡	...	≡	...	●*	●*	*≡	●≡	●	●	●
Cheltenham	...	●	●	●	●	...	...	...	...	●	...	...	●	●*	●	●	...	...	...	...	...	*	...	...	●*	●*	T	●	●	●▲Ψ	...
Carmarthen	...	●≡	...	●	●	...	...	...	...	●	●	...	●	●	●	●	●≡	●	...	...	...	...	...	...	*	...	...	●	●	●▲Ψ	●
Dartmoor	...	●	●≡	●≡	●≡	...	...	...	...	●	●	≡	...	...	●	≡	≡	≡	●≡	...	...	●*	...	●*	●*	●*≡	●*≡	●	●	●	...
Babbacombe	...	...	●	●	●	...	○Ψ	...	...	...	...	...	...	...	●○	●○	●≡	≡	●≡	...	○	...	*	●*	*	●	●	●	●	●	○Ψ
Downside	...	●	●	●	...	...	Ψ	...	●	●	●	...	...	●*	●	●	≡	≡	≡	...	●	●*	...	...	●*	●*	*	●	●	●▲	●
Marlborough	...	...	●	●Ψ	●	...	Ψ	...	...	●	...	...	●	●*	●	●	...	●≡	≡	...	●	●*	*	...	●*	*	...	●	●▲	●	Ψ
Strathfield Turgiss ..	≡	...	●Ψ	Ψ	...	...	Ψ≡	≡	...	≡	...	...	...	●*	...	...	●≡	●≡	≡	...	●	*	*	*	●*	*≡	≡	●	●	●	...
Norwood	≡	≡	●Ψ	...	●	Ψ	≡	≡	...	●≡	...	...	≡	●*	○	●	≡	●≡	○≡	≡	●≡	*	*	●*	●*▲	●*	...	●	●▲	●Ψ	○Ψ
Croydon	...	●	●Ψ	...	●	...	...	...	...	●≡	...	...	...	●*	...	●	...	●	...	...	*	*	*	●*	●*	●*	...	●	...	●Ψ	...
Bournemouth	...	...	●	●	●	...	...	...	...	...	...	...	...	...	●	●	≡	●≡	●	...	...	...	...	●	...	...	...	●	...	●	...
Eastbourne	≡	...	●	●	●	...	...	Ψ	...	●*	...	...	...	...	●	...	...	●≡	...	...	...	...	...	*	●*	●	...	...	...	...	●
Ramsgate	●≡	...	●Ψ	...	●	...	...	...	...	...	●	...	...	●*	...	...	...	...	...	...	...	...	...	*▲	●*	●*	●	●	...	Ψ	...
Audley End	●≡	...	●Ψ	●	●	...	...	...	...	●	T	...	●	●*	●	...	*	●	...	...	●	●*	*	●	●*	●*	*	●	●	●	●▲☇
Hillington	...	...	●	...	●	...	...	...	...	●	...	...	●*	●*	●*	●*	...	●	...	●	...	...	...	...	●*	●*	●*	●	●T	●Ψ	●▲☇
Lowestoft	...	...	●	...	...	...	...	...	...	...	...	●	●*	●*	...	●	...	●	...	...	...	...	...	●	●	*	...	●	●T	●	●≡

Abstract of Meteorological Observations for the Month of February, 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
					Means of		Absolute Min. and Max.										Total Fall.	Greatest Fall in 24 hours.															
		9 a.m.	9 p.m.	Mean.	Min.	Max.	Min.	Date.	Max.	Date.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.		Amnt.	Date.	Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	29·480	33·4	34·3	33·8	30·3	39·2	20·2	25	46·2	6	33·1	33·8	96	94	8·2	7·1	2·78	·56	6	21	7	2	15	1	3	8	10	5	2	4	2	1	21
Gainford	·521	34·4	33·9	34·1	32·9	39·4	18·8	25	49·7	27	33·5	33·0	91	90	8·7	8·0	3·69	·45	12	25	19	0	19	0	5	12	6	4	0	8	1	9	11
Wakefield	·533	36·2	36·1	36·1	32·7	40·2	24·7	25	53·1	9	35·4	35·2	92	92	9·2	8·5	2·50	·50	8	21	7	0	20	1	8	7	10	7	3	6	9	5	1
Kelstern	·541	34·6	33·2	33·9	30·1	38·5	18·1	24	52·4	9	33·9	32·9	93	97	8·8	7·4	3·07	·66	8	23	11	1	19	0	7	5	8	8	9	6	4	8	1
Mansfield	·537	34·9	34·7	34·8	31·8	40·0	19·0	24	52·1	9	34·3	33·8	94	91	8·9	7·8	3·01	·54	13	20	11	1	19	0	7	6	5	2	6	8	3	1	18
Buxton	·553	34·2	32·6	33·4	28·6	37·3	13·8	22	47·1	10	33·4	31·6	92	88	9·6	8·1	4·73	·67	7	21	11	0	19	0	4	6	10	7	0	8	5	13	3
Cheadle	·529	34·3	34·2	34·3	31·0	39·0	21·9	24	53·0	9	33·8	33·7	94	94	9·5	7·3	4·09	·72	8	20	10	0	18	5	9	3	10	3	6	9	4	9	3
Llandudno	·503	39·2	38·5	38·9	35·2	43·1	28·2	1	50·8	10	37·3	37·1	85	88	7·8	7·3	3·19	·78	15	16	7	0	13	2	2	7	6	11	5	5	16	4	0
Chester	·503	36·9	36·9	36·9	33·3	42·3	26·3	2	52·0	9	35·8	35·6	90	88	..	..	2·36	·33	8	19	8	..	..	1	12	2	1	6	14	5	2	8	6
Shrewsbury (Leaton)	·533	36·0	36·1	36·0	31·2	41·6	21·0	25	54·2	27	35·2	35·4	92	93	..	..	2·76	1·15	8	20	9	..	..	..	5	3	3	6	0	6	9	3	21
Churchstoke	·540	36·2	36·4	36·3	31·9	42·0	20·3	25	52·4	9	35·2	35·6	90	93	8·0	8·0	2·74	·39	8	19	9	0	14	0	5	6	10	5	6	5	15	4	0
Cheltenham	·534	38·0	37·5	37·7	32·6	42·8	12·4	25	54·8	9	37·0	36·6	91	92	8·7	6·5	2·70	·38	13	23	9	2	15	0	5	2	3	15	6	9	1	13	2
Carmarthen	·514	40·0	38·9	39·4	34·7	45·7	24·2	25	52·2	11	39·0	38·1	91	93	7·4	7·3	4·94	·89	8	22	4	1	14	0	10	1	7	8	3	9	5	3	10
Dartmoor	·539	36·5	36·1	36·3	32·2	40·4	20·7	25	48·0	14	36·2	35·8	97	97	8·7	7·8	10·32	1·70	8	28	11	0	20	0	3	7	3	6	3	7	8	9	10
Babbacombe	·541	41·0	40·3	40·7	36·8	46·7	28·2	25	53·9	6	39·6	39·2	88	91	7·4	7·4	5·49	·93	1	24	10	0	13	8	8	5	6	3	6	15	7	4	2
Downside	·540	36·8	37·2	37·0	32·9	42·4	20·3	25	50·4	8	36·4	36·8	96	96	8·3	7·3	5·91	·75	10	24	10	0	16	1	5	7	3	7	4	18	6	6	0
Marlborough	·556	36·0	36·7	36·4	32·8	43·4	20·9	22	52·7	9	35·3	36·1	93	94	8·9	7·9	4·74	·65	8	23	7	0	20	0	4	3	2	3	1	11	4	2	26
Strathfield Turgiss	·553	37·7	37·7	37·7	33·0	43·4	16·6	24	52·1	8, 9	36·3	36·5	88	89	8·5	7·8	3·20	·41	8	24	9	2	19	0	8	4	2	7	5	15	6	6	3
Norwood	·548	37·0	38·3	37·6	34·2	42·7	17·1	24	52·8	9	36·0	37·2	91	90	8·5	8·7	3·58	·72	10	23	12	1	18	5	5	7	6	5	4	6	13	6	4
Croydon	·552	37·2	37·9	37·6	34·4	42·8	20·9	24	52·7	9	36·1	36·8	90	90	9·1	7·8	3·45	·53	10	23	13	1	19	0	5	6	5	6	5	15	6	1	7
Bournemouth	·520	38·3	38·8	38·6	35·8	42·9	27·0	23	48·0	8	37·2	37·8	90	92	6·7	5·8	3·92	·48	13	25	5	2	10	0	5	8	8	7	4	10	11	3	0
Eastbourne	·550	38·8	39·6	39·2	36·2	43·2	26·7	24	53·0	9	37·7	38·7	91	93	7·9	8·6	3·98	·92	9	21	8	1	18	0	4	7	7	4	1	5	11	16	1
Ramsgate	·581	37·8	38·5	38·1	34·7	42·7	26·9	1	52·6	8	36·8	37·5	91	91	9·1	8·8	3·22	·43	16	23	8	0	19	2	5	15	2	2	6	14	4	1	7
Audley End	·502	37·0	37·3	37·1	33·4	41·6	20·0	24	53·6	9	36·0	36·3	91	91	8·5	8·0	3·32	·72	10	26	14	1	21	0	1	10	2	11	0	15	3	14	0
Hillington	·528	36·8																															

Scaleby	●	●*	●	...	●▲	●	●	●	●	●	...	...	●	●	●	●	●	●*	●*	...	...	●*	●*	●*	...	●*	●≡	...
Gainford ..	●*	●*≡	●*≡	●*≡	●≡	●*	●*	●*	●	...	...	●	...	●*	●*	●*	●*≡	●*	●*	●*	●*	●*	●*	●*	●*	●	●	●
Wakefield ..	●	●*	●	...	●	●Ʊ	●	●	●	≡	...	...	●	●	●	...	●	●*	●*	●*	●*	●	●*	*	●	●	...	●
Kelstern	●	●*≡	●≡	*	●*≡	●	●	●≡	●	●≡	≡	...	●	●≡	●≡	●*≡	●≡	●*	●*	●*	●*	...	●*	≡	●*▲	●*	●≡	●≡
Mansfield ..	●*	●*≡	≡	...	●*	●	●	●	●	●	≡	...	●	●≡	●*	●	≡	●*	●*▲	●*	●*▲	●	●*	*	●*	...	≡	●≡
Buxton	*	●	●≡	*	●*▲	●	●	●	●	...	...	...	●	●≡	●	●*	●*≡	●*≡	●*	●*	●*	...	●*	...	●*	●	●▲	●
Cheadle	●*	●≡	≡	...	●*	●	●	●	●	...	≡	...	●≡	●≡	●≡	●	●*	●*≡	●*	●*	*	●	●*≡	*≡	*	●≡	●≡	●≡
Llandudno ..	●*≡	*≡	≡	≡	●	●	●≡	●	...	●≡	...	...	●≡	≡	●	●*	●*	●*	●*	●*	≡	...	●	▲	...	...	●	●
Chester	●*	●	...	≡	●	●	●	●	●	...	▲	...	●≡	...	●	●	●*≡	●*▲	●*	●*≡	*≡	●	●*	*▲	...	●	●≡	●
Shrewsbury	...	●	●	...	●	●Ʊ	●	●	●	≡	≡	≡	●≡	●≡	●≡	●	●*	●*	●*	●*≡	●*	●*	●*	*	...	*	●	●
Churchstoke	●*	●≡	≡	≡	●*≡	●≡	●≡	●	●≡	≡	≡	●≡	●≡	●≡	●≡	...	●*▲≡	●*≡	●▲≡	*	*≡	●	●*	●*≡	*	≡	●	●≡
Cheltenham	●*	●*	●	...	●	●	●	●	●	●	●	●	●	●	●	●	●	●*	●*	*	...	*	●*	●*	*	●	●≡	●
Carmarthen	●*▲	●	...	●	●	●	●	●	●	●	...	●	●	●	●▲	●ꓘ	●▲	●▲	●*	●*<	*	●	●	...	...	●	●≡	...
Dartmoor ..	●*≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●▲≡	●*▲≡	●*≡	●*≡	●*≡	●*≡	●*≡	●*≡	●*≡	●*≡	●*≡	●≡	●≡
Babbacombe	●*	●≡	●≡	...	●	●Ʊ	●	●○	●≡	●≡	●	●	●	≡	●≡	●	●*▲	●*	●*▲	●*▲<	●*	●*	●*▲	*▲	*	●	●	●≡
Downside ..	●*	●≡	●≡	...	●≡	●Ʊ	●	●	●	●≡	●	...	●	●	●≡	●	●	●*	●*	●*▲	●*	●*	●*	*	*	●*	●	●
Marlborough	●*	●≡	●	...	●*≡	●	●	●	●	●≡	●	...	●	●	●≡	●▲	●*	●*	●	●*	*	*	●	≡	●	●	●≡	●≡
Strathfield T.	●*▲	●▲≡	●*≡	*≡	●*	●	●	●	●	●≡	●	≡	●≡	●≡	●≡	●	●*	●	●	●*	●*≡	≡	●*	≡	*	●	●≡	●≡
Norwood	●*▲	●▲≡	●*≡	*	●	●○	●	●	●	●	●	...	●	...	●	●▲	●*≡	●*	●*	●*▲	●*	*≡	●*≡	≡	●*▲	●	●*≡	●
Croydon	●*▲	●≡	●*	*	●	●	●	●	●	●	●	...	●≡	...	●	●	●*≡	●*▲	●*	●*▲	●*	*	●*	...	●*	●*	●*	●
Bournemouth	●	●	●	...	●	●	●	●	●≡	●≡	●	●	●	●	●	●	●	●	●*	●*	●*	●*	●*	...	...	●	●≡	●
Eastbourne	●*	●≡	●	●	●	●Ʊ	●	●	●	●	●	...	●	...	●	●	●	...	●	●*▲<	●*▲	...	●*	*	*	*	●*	●≡
Ramsgate ..	...	●≡	●≡	●*	●*	●	●	●	●	●	...	...	●	●	●	●	●*	●	●	●*	*	●▲	*	●▲	●*▲	●*▲	●	●≡
Audley End	●*	●*≡	●≡	...	●*	●	●	●	●	●	●	●	●	●	●▲	●*	●*	●*	●*	●*	●*	●*	●*	...	●*	●*	●*	●≡
Hillington ..	●	*	...	*Ʊ	●	...	●	●	●	●	●	...	●	●	●*	●*	...	●*▲	●*	●*	*	●*	●*	●*	●*	●*	●*	●≡
Lowestoft ..	≡	●≡	●≡	...	●	●	...	●	●	●≡	...	●	●	●	●	●*	●*	●	●	...	●*▲	...	...	●	●*	...	●	●

EXPLANATION OF THE SYMBOLS.—● indicates rain; * snow; ▲ hail; ≡ fog; ꓘ thunderstorm; T thunder; < lightning; ○ solar halo; Ʊ lunar halo.

Abstract of Meteorological Observations for the Month of March, 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Total Fall.	Greatest Fall in 24 hours.		Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
					Min.	Max.	Min.	Date.	Max.	Date.								Amnt.	Date.														
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	29·905	38·1	37·6	37·9	32·8	44·7	18·2	14	53·9	30	36·8	36·3	89	88	7·2	6·8	1·95	·39	18	19	9	2	14	6	1	8	14	1	1	19	2	1	15
Gainford	·963	38·9	37·1	38·0	33·0	45·5	20·5	14	57·9	19	36·7	35·5	82	86	7·5	6·3	1·18	·39	13	14	10	2	13	2	1	23	1	5	2	16	5	5	4
Wakefield	·971	39·5	39·0	39·3	34·4	46·2	24·6	13	56·3	8	38·2	37·6	89	88	7·5	6·6	1·09	·27	17	12	6	2	13	3	6	8	9	5	4	8	19	3	0
Kelstern	·985	38·0	36·5	37·3	32·9	44·9	25·6	13	58·8	9	36·7	35·2	89	88	6·8	6·6	1·09	·19	28	17	8	5	17	1	6	8	10	4	7	12	7	7	1
Mansfield	29·983	38·2	37·0	37·6	34·0	46·4	26·8	13	57·5	9	36·5	35·7	85	88	7·3	5·2	·97	·27	26	15	9	6	13	0	8	6	10	1	5	14	10	1	7
Buxton	30·002	37·2	36·3	36·7	31·5	43·7	24·0	13	56·4	9	35·8	34·0	87	87	8·2	6·5	2·74	·68	16	15	9	3	15	0	1	1	15	7	0	10	9	15	4
Cheadle	29·983	37·6	37·2	37·4	32·6	45·3	24·9	13	56·6	19	36·4	35·8	89	88	7·5	5·4	1·10	·30	16	15	6	6	14	10	4	4	15	4	6	8	7	9	5
Llandudno	·949	42·7	41·0	41·8	37·4	46·3	28·0	26	54·8	8	40·0	38·7	80	82	6·7	6·1	1·47	·32	16	12	5	3	14	4	3	4	18	2	4	7	21	3	0
Chester	·958	40·8	39·7	40·2	34·4	48·1	25·3	13	57·2	19	38·4	37·6	81	83	..	..	·95	·28	16	14	4	..	..	7	4	1	11	5	9	9	10	5	8
Shrewsbury (Leaton)	29·990	39·8	38·1	39·0	33·1	47·1	20·0	13	57·3	12	38·0	36·6	85	87	6·1	5·1	1·04	·39	17	16	5	8	10	0	3	4	12	6	2	8	21	1	5
Churchstoke	30·000	39·1	38·7	38·9	33·2	46·2	22·3	13	56·4	7	37·7	37·2	88	87	7·3	7·0	1·30	·35	17	15	4	0	12	2	9	9	6	3	5	23	7	0	0
Cheltenham	29·992	40·5	39·3	39·9	32·8	48·2	23·0	2	59·8	19	39·1	37·9	88	89	7·6	6·9	·98	·22	30	14	4	2	16	0	6	6	10	4	9	12	9	6	0
Carmarthen	·975	42·1	40·1	41·1	35·6	50·7	24·7	2	61·9	19	40·3	38·8	86	89	6·8	5·6	2·75	·63	17	15	1	6	12	0	8	1	14	5	1	13	6	2	12
Dartmoor	·980	37·9	36·0	36·9	32·7	46·4	23·4	25	54·4	9.19	36·8	35·6	90	96	6·3	5·4	3·02	·75	26	16	5	4	9	0	4	9	12	3	2	7	12	7	6
Babbacombe	·990	42·6	40·8	41·7	36·5	48·9	26·2	14	56·6	16,29	40·4	39·4	83	88	6·7	6·1	·56	·18	28	13	3	5	13	6	6	16	6	0	3	19	6	5	1
Downside	29·991	38·7	38·6	38·7	34·5	46·9	27·8	24,25,26	59·8	19	37·9	37·5	93	91	7·0	5·8	1·58	·35	31	17	5	5	13	2	1	20	0	5	2	23	5	6	0
Marlborough	30·009	39·5	38·7	39·1	33·9	48·1	27·3	2	62·5	19	37·9	37·5	87	90	6·9	7·0	·94	·23	30	15	5	5	18	0	3	13	2	2	0	16	2	2	22
Strathfield Turgiss	30·001	41·6	39·6	40·6	33·7	49·0	26·8	9	63·5	19	39·2	37·5	81	83	7·6	6·5	·48	·13	29	9	6	5	18	0	3	14	2	5	4	12	12	8	2
Norwood	29·992	40·6	40·2	40·4	35·0	48·8	27·8	8	64·2	19	38·6	38·3	84	84	6·8	5·8	·64	·10	14	13	6	6	12	1	7	10	8	1	3	9	13	3	8
Croydon	·998	40·4	39·7	40·0	35·0	48·8	28·6	8	65·2	19	38·5	37·9	85	85	6·5	5·6	·56	·12	14	12	7	6	12	0	4	15	3	1	7	19	5	1	7
Bournemouth	·959	41·1	40·6	40·8	36·4	47·0	30·0	25	56·5	19	39·2	39·1	85	88	5·4	5·0	·62	·19	30	10	0	9	11	0	8	14	6	3	0	15	5	10	1
Eastbourne	29·991	41·5	40·6	41·0	35·8	47·5	30·1	25	58·8	9	39·6	39·1	85	88	6·7	5·1	1·14	·43	31	9	3	5	11	1	2	17	9	2	0	12	11	8	1
Ramsgate	30·032	41·3	40·2	40·8	36·0	48·0	29·6	24	61·2	9	39·6	38·9	86	89	6·6	5·7	·70	·13	11, 28	9	4	5	11	1	1	16	5	0	2	17	5	6	10
AudleyEnd	29·965	40·0	38·6	39·3	33·2	48·0	26·0	8	64·0	19	38·1	37·1	84	87	6·9	6·4	·91	·19	30	18	7	3	14	0	0	16	0	8	3	19	1	14	1
Hillington	·969	40·5	38·0	39·3	33·3	47·5	26·5	2	64·1	19	38·9	36·5	87	87	7·7	7·1	·74	·11	28	15	7	3	18	3	3	7	13	7	2	21	3	5	1
Lowestoft	29·977	40·2	38·8	39·5	34·1	45·9	27·3	14	61·7	9	38·0	37·0	82	85	7·1	5·9	1·22	·24	13, 18	12	3	6	14	2	6	3	14	3	7	6	19	3	1
Columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Scaleby	...	●	●	●	●	●	...	≡	...	●	●	...	●✳	●✳	●	...	●✳	●	...	...	...	...	...	●✳	●✳	●✳	●✳	●✳	✳	●	●
Gainford	...	●Ψ	...	...	●	...	...	●	...	...	●	●	●✳	●✳	●✳	●✳	✳	≡	●≡	≡	≡	●	●	✳	●✳	●✳	✳	✳	...	...	...
Wakefield	Ψ	...	...	Ψ	●	...	Ψ	Ψ	...	...	...	●Ψ	●	●✳	●✳	✳	●	...	...	...	●	...	...	...	●✳	●✳	●✳	●	...	●K	...
Kelstern	...	●	Ψ	...	●	...	...	...	...	●	...	...	●✳	●✳	●✳	●≡	●	●≡	≡	≡	●✳≡	✳	...	...	●	●✳	●✳	●✳	●	●	●
Mansfield	...	●	✳	...	●	...	...	...	...	...	...	...	●	●✳	●	●	●✳	...	●≡	≡	●✳	...	...	✳	●✳	●✳	●✳	●✳	●	Ψ	●▲
Buxton	...	●	...	...	●	..	...	...	●	●	●	●✳	●	✳	●	●✳	●	●≡	≡	...	●	✳	...	✳	✳	●✳	✳	●✳	...	●T	...
Cheadle	...	●	...	...	●	...	...	▲	...	●	...	...	●	●✳	●	●	●✳	●≡	≡	...	≡	...	...	✳	●✳	●✳	✳	●	●	●T	●▲
Llandudno	...	●	...	...	●	...	≡	≡	...	●	...	...	●	...	●	●≡	●✳	●	≡	≡	...	...	...	✳	✳	●✳	●✳	●	●	...	...
Chester	...	●	...	...	●	...	...	≡	...	●≡	...	...	●	●✳	●	●	●	●	≡	≡	...	...	...	✳	...	●✳	●✳	●	...	●	●
Shrewsbury (Leaton)	...	●	...	...	●	...	●	≡	...	≡	...	...	●	✳≡	●	●	●	●	●≡	≡	...	...	...	✳	●✳	●✳	●✳	●	●	●Ψ	●
Churchstoke	...	●	≡	...	●	≡	...	...	...	●≡	...	...	●	●✳≡	●≡	●≡	●≡	●≡	≡	≡	≡	...	≡	...	●✳	●✳	✳≡	●≡	●	●	●
Cheltenham	...	●	●	●	●	...	...	...	...	●	...	...	●	●✳	●	●	...	...	...	...	...	✳	...	...	●✳	●✳	T	●	●	●▲Ψ	...
Carmarthen	...	●≡	...	●	●	...	...	...	...	●	●	...	●	●	●	●	●≡	●	...	...	...	...	...	...	✳	...	...	●	●	●▲Ψ	●
Dartmoor	...	●	●≡	●≡	●≡	...	...	...	...	●	●	≡	...	...	●	≡	≡	≡	●≡	...	...	●✳	...	●✳	●✳	●✳≡	●✳≡	●	●	●	...
Babbacombe	...	...	●	●	●	...	○Ψ	...	...	...	...	...	...	...	●○	●○	●≡	≡	●≡	...	○	...	✳	●✳	✳	●	●	●	●	●	○Ψ
Downside	...	●	●	●	...	...	Ψ	...	●	●	●	...	...	●✳	●	●	≡	≡	≡	...	●	●✳	...	...	●✳	●✳	✳	●	●	●▲	●
Marlborough	...	...	●	●Ψ	●	...	Ψ	...	...	●	...	...	●	●✳	●	●	...	●≡	≡	...	●	●✳	✳	...	●✳	✳	...	●	●▲	●	Ψ
Strathfield Turgiss	≡	...	●Ψ	Ψ	...	...	Ψ≡	≡	...	≡	...	...	...	●✳	...	...	●≡	●≡	≡	...	●	✳	✳	✳	●✳	✳≡	≡	●	●	●	...
Norwood	≡	≡	●Ψ	...	●	Ψ	≡	≡	...	●≡	...	...	≡	●✳	○	●	≡	●≡	○≡	≡	●≡	✳	✳	●✳	●✳▲	●✳	...	●	●▲	●Ψ	○Ψ
Croydon	...	●	●Ψ	...	●	...	...	...	...	●≡	...	...	...	●✳	...	●	...	●	...	...	✳	✳	✳	●✳	●✳	●✳	...	●	...	●Ψ	...
Bournemouth	...	...	●	●	●	...	...	...	...	...	...	...	...	...	●	●	≡	●≡	●	...	...	...	...	●	...	...	...	●	...	●	...
Eastbourne	≡	...	●	●	●	...	...	Ψ	...	●✳	...	...	...	...	●	...	...	●≡	...	...	...	...	...	✳	●✳	●	...	...	...	...	●
Ramsgate	●≡	...	●Ψ	...	●	...	...	...	...	...	●	...	...	●✳	...	...	...	...	...	...	...	...	...	✳▲	●✳	●✳	●	●	...	Ψ	...
Audley End	●≡	...	●Ψ	●	●	...	...	...	...	●	T	...	●	●✳	●	...	✳	●	...	...	●	●✳	✳	●	●✳	●✳	✳	●	●	●	●▲K
Hillington	...	...	●	...	●	...	...	...	...	●	...	...	●✳	●✳	●✳	●✳	...	●	...	●	...	...	...	...	●✳	●✳	●✳	●	●T	●Ψ	●▲K
Lowestoft	...	...	●	...	...	...	...	...	...	...	...	●	●✳	●✳	...	●	...	●	...	...	...	...	...	●	●	✳	...	●	●T	●	●≡

Abstract of Meteorological Observations for the Month of FEBRUARY, 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
					Means of		Absolute Min. and Max.										Total Fall.	Greatest Fall in 24 hours.															
		9 a.m.	9 p.m.	Mean.	Min.	Max.	Min.	Date.	Max.	Date.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.		Amnt.	Date.	Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	29·480	33·4	34·3	33·8	30·3	39·2	20·2	25	46·2	6	33·1	33·8	96	94	8·2	7·1	2·78	·56	6	21	7	2	15	1	3	8	10	5	2	4	2	1	21
Gainford	·521	34·4	33·9	34·1	32·9	39·4	18·8	25	49·7	27	33·5	33·0	91	90	8·7	8·0	3·69	·45	12	25	19	0	19	0	5	12	6	4	0	8	1	9	11
Wakefield	·533	36·2	36·1	36·1	32·7	40·2	24·7	25	53·1	9	35·4	35·2	92	92	9·2	8·5	2·50	·50	8	21	7	0	20	1	8	7	10	7	3	6	9	5	1
Kelstern	·541	34·6	33·2	33·9	30·1	38·5	18·1	24	52·4	9	33·9	32·9	93	97	8·8	7·4	3·07	·66	8	23	11	1	19	0	7	5	8	8	9	6	4	8	1
Mansfield	·537	34·9	34·7	34·8	31·8	40·0	19·0	24	52·1	9	34·3	33·8	94	91	8·9	7·8	3·01	·54	13	20	11	1	19	0	7	6	5	2	6	8	3	1	18
Buxton	·553	34·2	32·6	33·4	28·6	37·3	13·8	22	47·1	10	33·4	31·6	92	88	9·6	8·1	4·73	·67	7	21	11	0	19	0	4	6	10	7	0	8	5	13	3
Cheadle	·529	34·3	34·2	34·3	31·0	39·0	21·9	24	53·0	9	33·8	33·7	94	94	9·5	7·3	4·09	·72	8	20	10	0	18	5	9	3	10	3	6	9	4	9	3
Llandudno	·503	39·2	38·5	38·9	35·2	43·1	28·2	1	50·8	10	37·3	37·1	85	88	7·8	7·3	3·19	·78	15	16	7	0	13	2	2	7	6	11	5	5	16	4	0
Chester	·503	36·9	36·9	36·9	33·3	42·3	26·3	2	52·0	9	35·8	35·6	90	88	..	..	2·36	·33	8	19	8	..	..	1	12	2	1	6	14	5	2	8	6
Shrewsbury (Leaton)	·533	36·0	36·1	36·0	31·2	41·6	21·0	25	54·2	27	35·2	35·4	92	93	..	..	2·76	1·15	8	20	9	..	..	..	5	3	3	6	0	6	9	3	21
Churchstoke	·540	36·2	36·4	36·3	31·9	42·0	20·3	25	52·4	9	35·2	35·6	90	93	8·0	8·0	2·74	·39	8	19	9	0	14	0	5	6	10	5	6	5	15	4	0
Cheltenham	·534	38·0	37·5	37·7	32·6	42·8	12·4	25	54·8	9	37·0	36·6	91	92	8·7	6·5	2·70	·38	13	23	9	2	15	0	5	2	3	15	6	9	1	13	2
Carmarthen	·514	40·0	38·9	39·4	34·7	45·7	24·2	25	52·2	11	39·0	38·1	91	93	7·4	7·3	4·94	·89	8	22	4	1	14	0	10	1	7	8	3	9	5	3	10
Dartmoor	·539	36·5	36·1	36·3	32·2	40·4	20·7	25	48·0	14	36·2	35·8	97	97	8·7	7·8	10·32	1·70	8	28	11	0	20	0	3	7	3	6	3	7	8	9	10
Babbacombe	·541	41·0	40·3	40·7	36·8	46·7	28·2	25	53·9	6	39·6	39·2	88	91	7·4	7·4	5·49	·93	1	24	10	0	13	8	8	5	6	3	6	15	7	4	2
Downside	·540	36·8	37·2	37·0	32·9	42·4	20·3	25	50·4	8	36·4	36·8	96	96	8·3	7·3	5·91	·75	10	24	10	0	16	1	5	7	3	7	4	18	6	6	0
Marlborough	·556	36·0	36·7	36·4	32·8	43·4	20·9	22	52·7	9	35·3	36·1	93	94	8·9	7·9	4·74	·65	8	23	7	0	20	0	4	3	2	3	1	11	4	2	26
Strathfield Turgiss	·553	37·7	37·7	37·7	33·0	43·4	16·6	24	52·1	8, 9	36·3	36·5	88	89	8·5	7·8	3·20	·41	8	24	9	2	19	0	8	4	2	7	5	15	6	6	3
Norwood	·548	37·0	38·3	37·6	34·2	42·7	17·1	24	52·8	9	36·0	37·2	91	90	8·5	8·7	3·58	·72	10	23	12	1	18	5	5	7	6	5	4	6	13	6	4
Croydon	·552	37·2	37·9	37·6	34·4	42·8	20·9	24	52·7	9	36·1	36·8	90	90	9·1	7·8	3·45	·53	10	23	13	1	19	0	5	6	5	6	5	15	6	1	7
Bournemouth	·520	38·3	38·8	38·6	35·8	42·9	27·0	23	48·0	8	37·2	37·8	90	92	6·7	5·8	3·92	·48	13	25	5	2	10	0	5	8	8	7	4	10	11	3	0
Eastbourne	·550	38·8	39·6	39·2	36·2	43·2	26·7	24	53·0	9	37·7	38·7	91	93	7·9	8·6	3·98	·92	9	21	8	1	18	0	4	7	7	4	1	5	11	16	1
Ramsgate	·581	37·8	38·5	38·1	34·7	42·7	26·9	1	52·6	8	36·8	37·5	91	91	9·1	8·8	3·22	·43	16	23	8	0	19	2	5	15	2	2	6	14	4	1	7
Audley End	·502	37·0	37·3	37·1	33·4	41·6	20·0	24	53·6	9	36·0	36·3	91	91	8·5	8·0	3·32	·72	10	26	14	1	21	0	1	10	2	11	0	15	3	14	0
Hillington	·528	36·8	35·5	36·1	32·0	40·8	20·5	24	54·9	9	35·9	34·8	92	93	8·6	7·9	2·27	·45	8	21	14	0	16	0	2	10	3	13	8	12	1	7	0
Lowestoft	29·537	37·0	36·3	36·7	33·0	40·8	26·7	24	54·2	9	35·6	35·0	88	88	9·1	7·9	2·60	·46	16	20	4	0	16	1	2	6	7	12	3	10	11	5	0
Columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Scaleby	●	●*	●	...	●▲	●	●	●	●	●	...	...	●	●	●	●	●	●*	●*	...	...	●*	●*	●*	...	●*	●≡	...
Gainford ..	●*	●*≡	●*≡	●*≡	●≡	●*	●*	●*	●	...	...	●	...	●*	●*	●*	●*≡	●*	●*	●*	●*	●*	●*	●*	●*	●	●	●
Wakefield ..	●	●*	●	...	●	●Ʊ	●	●	●	≡	...	...	●	●	●	...	●	●*	●*	●*	●*	●	●*	*	●	●	...	●
Kelstern	●	●*≡	●≡	*	●*≡	●	●	●≡	●	●≡	≡	...	●	●≡	●≡	●*≡	●≡	●*	●*	●*	●*	...	●*	≡	●*▲	●*	●≡	●≡
Mansfield ..	●*	●*≡	≡	...	●*	●	●	●	●	●	≡	...	●	●≡	●*	●	≡	●*	●*▲	●*	●*▲	●	●*	*	●*	...	≡	●≡
Buxton	*	●	●≡	*	●*▲	●	●	●	●	...	...	...	●	●≡	●	●*	●*≡	●*≡	●*	●*	●*	...	●*	...	●*	●	●▲	●
Cheadle	●*	●≡	≡	...	●*	●	●	●	●	...	≡	...	●≡	●≡	●≡	●	●*	●*≡	●*	●*	*	●	●*≡	*≡	*	●≡	●≡	●≡
Llandudno ..	●*≡	*≡	≡	≡	●	●	●≡	●	...	●≡	...	...	●≡	≡	●	●*	●*	●*	●*	●*	≡	...	●	▲	...	...	●	●
Chester	●*	●	...	≡	●	●	●	●	●	...	▲	...	●≡	...	●	●	●*≡	●*▲	●*	●*≡	*≡	●	●*	*▲	...	●	●≡	●
Shrewsbury	...	●	●	...	●	●Ʊ	●	●	●	≡	≡	≡	●≡	●≡	●≡	●	●*	●*	●*	●*≡	●*	●*	●*	*	...	*	●	●
Churchstoke	●*	●≡	≡	≡	●*≡	●≡	●≡	●	●≡	≡	≡	●≡	●≡	●≡	●≡	...	●*▲≡	●*≡	●▲≡	*	*≡	●	●*	●*≡	*	≡	●	●≡
Cheltenham	●*	●*	●	...	●	●	●	●	●	●	●	●	●	●	●	●	●	●*	●*	*	...	*	●*	●*	*	●	●≡	●
Carmarthen	●*▲	●	...	●	●	●	●	●	●	●	...	●	●	●	●▲	●ꓘ	●▲	●▲	●*	●*<	*	●	●	...	...	●	●≡	...
Dartmoor ..	●*≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●≡	●▲≡	●*▲≡	●*≡	●*≡	●*≡	●*≡	●*≡	●*≡	●*≡	●*≡	●*≡	●≡	●≡
Babbacombe	●*	●≡	●≡	...	●	●Ʊ	●	●○	●≡	●≡	●	●	●	≡	●≡	●	●*▲	●*	●*▲	●*▲<	●*	●*	●*▲	*▲	*	●	●	●≡
Downside ..	●*	●≡	●≡	...	●≡	●Ʊ	●	●	●	●≡	●	...	●	●	●≡	●	●	●*	●*	●*▲	●*	●*	●*	*	*	●*	●	●
Marlborough	●*	●≡	●	...	●*≡	●	●	●	●	●≡	●	...	●	●	●≡	●▲	●*	●*	●	●*	*	*	●	≡	●	●	●≡	●≡
Strathfield T.	●*▲	●▲≡	●*≡	*≡	●*	●	●	●	●	●≡	●	≡	●≡	●≡	●≡	●	●*	●	●	●*	●*≡	≡	●*	≡	*	●	●≡	●≡
Norwood	●*▲	●▲≡	●*≡	*	●	●○	●	●	●	●	●	...	●	...	●	●▲	●*≡	●*	●*	●*▲	●*	*≡	●*≡	≡	●*▲	●	●*≡	●
Croydon	●*▲	●≡	●*	*	●	●	●	●	●	●	●	...	●≡	...	●	●	●*≡	●*▲	●*	●*▲	●*	*	●*	...	●*	●*	●*	●
Bournemouth	●	●	●	...	●	●	●	●	●≡	●≡	●	●	●	●	●	●	●	●	●*	●*	●*	●*	●*	...	...	●	●≡	●
Eastbourne	●*	●≡	●	●	●	●Ʊ	●	●	●	●	●	...	●	...	●	●	●	...	●	●*▲<	●*▲	...	●*	*	*	*	●*	●≡
Ramsgate ..	...	●≡	●≡	●*	●*	●	●	●	●	●	...	...	●	●	●	●	●*	●	●	●*	*	●▲	*	●▲	●*▲	●*▲	●	●≡
Audley End	●*	●*≡	●≡	...	●*	●	●	●	●	●	●	●	●	●	●▲	●*	●*	●*	●*	●*	●*	●*	●*	...	●*	●*	●*	●≡
Hillington ..	●	*	...	*Ʊ	●	...	●	●	●	●	●	...	●	●	●*	●*	...	●*▲	●*	●*	*	●*	●*	●*	●*	●*	●*	●≡
Lowestoft ..	≡	●≡	●≡	...	●	●	...	●	●	●≡	...	●	●	●	●	●*	●*	●	●	...	●*▲	...	...	●	●*	...	●	●

EXPLANATION OF THE SYMBOLS.—● indicates rain; * snow; ▲ hail; ≡ fog; ꓘ thunderstorm; T thunder; < lightning; ○ solar halo; Ʊ lunar halo.

Abstract of Meteorological Observations for the Month of MARCH, 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
					Means of		Absolute Min. and Max.										Total Fall.	Greatest Fall in 24 hours.															
		9 a.m.	9 p.m.	Mean.	Min.	Max.	Min.	Date.	Max.	Date.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.		Amnt.	Date.	Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	29·905	38·1	37·6	37·9	32·8	44·7	18·2	14	53·9	30	36·8	36·3	89	88	7·2	6·8	1·95	·39	18	19	9	2	14	6	1	8	14	1	1	19	2	1	15
Gainford	·963	38·9	37·1	38·0	33·0	45·5	20·5	14	57·9	19	36·7	35·5	82	86	7·5	6·3	1·18	·39	13	14	10	2	13	2	1	23	1	5	2	16	5	5	4
Wakefield	·971	39·5	39·0	39·3	34·4	46·2	24·6	13	56·3	8	38·2	37·6	89	88	7·5	6·6	1·09	·27	17	12	6	2	13	3	6	8	9	5	4	8	19	3	0
Kelstern	·985	38·0	36·5	37·3	32·9	44·9	25·6	13	58·8	9	36·7	35·2	89	88	6·8	6·6	1·09	·19	28	17	8	5	17	1	6	8	10	4	7	12	7	7	1
Mansfield	29·983	38·2	37·0	37·6	34·0	46·4	26·8	13	57·5	9	36·5	35·7	85	88	7·3	5·2	·97	·27	26	15	9	6	13	0	8	6	10	1	5	14	10	1	7
Buxton	30·002	37·2	36·3	36·7	31·5	43·7	24·0	13	56·4	9	35·8	34·0	87	87	8·2	6·5	2·74	·68	16	15	9	3	15	0	1	1	15	7	0	10	9	15	4
Cheadle	29·983	37·6	37·2	37·4	32·6	45·3	24·9	13	56·6	19	36·4	35·8	89	88	7·5	5·4	1·10	·30	16	15	6	6	14	10	4	4	15	4	6	8	7	9	5
Llandudno	·949	42·7	41·0	41·8	37·4	46·3	28·0	26	54·8	8	40·0	38·7	80	82	6·7	6·1	1·47	·32	16	12	5	3	14	4	3	4	18	2	4	7	21	3	0
Chester	·958	40·8	39·7	40·2	34·4	48·1	25·3	13	57·2	19	38·4	37·6	81	83	..	..	·95	·28	16	14	4	..	..	7	4	1	11	5	9	9	10	5	8
Shrewsbury (Leaton)	29·990	39·8	38·1	39·0	33·1	47·1	20·0	13	57·3	12	38·0	36·6	85	87	6·1	5·1	1·04	·39	17	16	5	8	10	0	3	4	12	6	2	8	21	1	5
Churchstoke	30·000	39·1	38·7	38·9	33·2	46·2	22·3	13	56·4	7	37·7	37·2	88	87	7·3	7·0	1·30	·35	17	15	4	0	12	2	9	9	6	3	5	23	7	0	0
Cheltenham	29·992	40·5	39·3	39·9	32·8	48·2	23·0	2	59·8	19	39·1	37·9	88	89	7·6	6·9	·98	·22	30	14	4	2	16	0	6	6	10	4	9	12	9	6	0
Carmarthen	·975	42·1	40·1	41·1	35·6	50·7	24·7	2	61·9	19	40·3	38·8	86	89	6·8	5·6	2·75	·63	17	15	1	6	12	0	8	1	14	5	1	13	6	2	12
Dartmoor	·980	37·9	36·0	36·9	32·7	46·4	23·4	25	54·4	9.19	36·8	35·6	90	96	6·3	5·4	3·02	·75	26	16	5	4	9	0	4	9	12	3	2	7	12	7	6
Babbacombe	·990	42·6	40·8	41·7	36·5	48·9	26·2	14	56·6	16,29	40·4	39·4	83	88	6·7	6·1	·56	·18	28	13	3	5	13	6	6	16	6	0	3	19	6	5	1
Downside	29·991	38·7	38·6	38·7	34·5	46·9	27·8	24,25,26	59·8	19	37·9	37·5	93	91	7·0	5·8	1·58	·35	31	17	5	5	13	2	1	20	0	5	2	23	5	6	0
Marlborough	30·009	39·5	38·7	39·1	33·9	48·1	27·3	2	62·5	19	37·9	37·5	87	90	6·9	7·0	·94	·23	30	15	5	5	18	0	3	13	2	2	0	16	2	2	22
Strathfield Turgiss	30·001	41·6	39·6	40·6	33·7	49·0	26·8	9	63·5	19	39·2	37·5	81	83	7·6	6·5	·48	·13	29	9	6	5	18	0	3	14	2	5	4	12	12	8	2
Norwood	29·992	40·6	40·2	40·4	35·0	48·8	27·8	8	64·2	19	38·6	38·3	84	84	6·8	5·8	·64	·10	14	13	6	6	12	1	7	10	8	1	3	9	13	3	8
Croydon	·998	40·4	39·7	40·0	35·0	48·8	28·6	8	65·2	19	38·5	37·9	85	85	6·5	5·6	·56	·12	14	12	7	6	12	0	4	15	3	1	7	19	5	1	7
Bournemouth	·959	41·1	40·6	40·8	36·4	47·0	30·0	25	56·5	19	39·2	39·1	85	88	5·4	5·0	·62	·19	30	10	0	9	11	0	8	14	6	3	0	15	5	10	1
Eastbourne	29·991	41·5	40·6	41·0	35·8	47·5	30·1	25	58·8	9	39·6	39·1	85	88	6·7	5·1	1·14	·43	31	9	3	5	11	1	2	17	9	2	0	12	11	8	1
Ramsgate	30·032	41·3	40·2	40·8	36·0	48·0	29·6	24	61·2	9	39·6	38·9	86	89	6·6	5·7	·70	·13	11, 28	9	4	5	11	1	1	16	5	0	2	17	5	6	10
AudleyEnd	29·965	40·0	38·6	39·3	33·2	48·0	26·0	8	64·0	19	38·1	37·1	84	87	6·9	6·4	·91	·19	30	18	7	3	14	0	0	16	0	8	3	19	1	14	1
Hillington	·969	40·5	38·0	39·3	33·3	47·5	26·5	2	64·1	19	38·9	36·5	87	87	7·7	7·1	·74	·11	28	15	7	3	18	3	3	7	13	7	2	21	3	5	1
Lowestoft	29·977	40·2	38·8	39·5	34·1	45·9	27·3	14	61·7	9	38·0	37·0	82	85	7·1	5·9	1·22	·24	13, 18	12	3	6	14	2	6	3	14	3	7	6	19	3	1
Columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

Phenomena observed at the Stations during March, 1879.

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Scaleby	...	●	●	●	●	●	...	≡	...	●	●	...	●✻	●✻	●	...	●✻	●	...	...	...	...	...	●✻	●✻	●✻	●✻	●✻	✻	●	●
Gainford	...	●Ψ	...	...	●	...	...	●	...	...	●	●	●✻	●✻	●✻	●✻	✻	≡	●≡	≡	≡	●	●	✻	●✻	●✻	✻	✻	...	...	...
Wakefield	Ψ	...	...	Ψ	●	...	Ψ	Ψ	...	...	...	●Ψ	●	●✻	●✻	✻	●	...	...	...	●	...	...	...	●✻	●✻	●✻	●	...	●K	...
Kelstern	...	●	Ψ	...	●	...	...	...	...	●	...	...	●✻	●✻	●✻	●≡	●	●≡	≡	≡	●✻≡	✻	...	...	●	●✻	●✻	●✻	●	●	●
Mansfield	...	●	✻	...	●	...	...	...	...	...	...	...	●	●✻	●	●	●✻	...	●≡	≡	●✻	...	...	✻	●✻	●✻	●✻	●✻	●	Ψ	●▲
Buxton	...	●	...	...	●	..	...	...	●	●	●	●✻	●	✻	●	●✻	●	●≡	≡	...	●	✻	...	✻	✻	●✻	✻	●✻	...	●T	...
Cheadle	...	●	...	...	●	...	...	▲	...	●	...	...	●	●✻	●	●	●✻	●≡	≡	...	≡	...	...	✻	●✻	●✻	✻	●	●	●T	●▲
Llandudno	...	●	...	...	●	...	≡	≡	...	●	...	...	●	...	●	●≡	●✻	●	≡	≡	...	...	...	✻	✻	●✻	●✻	●	●	...	...
Chester	...	●	...	...	●	...	...	≡	...	●≡	...	...	●	●✻	●	●	●	●	≡	≡	...	...	...	✻	...	●✻	●✻	●	...	●	●
Shrewsbury (Leaton)	...	●	...	...	●	...	●	≡	...	≡	...	...	●	✻≡	●	●	●	●	●≡	≡	...	...	...	✻	●✻	●✻	●✻	●	●	●Ψ	●
Churchstoke	...	●	≡	...	●	≡	...	...	...	●≡	...	...	●	●✻≡	●≡	●≡	●≡	●≡	≡	≡	≡	...	≡	...	●✻	●✻	✻≡	●≡	●	●	●
Cheltenham	...	●	●	●	●	...	...	...	...	●	...	...	●	●✻	●	●	...	...	...	...	...	✻	...	...	●✻	●✻	T	●	●	●▲Ψ	...
Carmarthen	...	●≡	...	●	●	...	...	...	...	●	●	...	●	●	●	●	●≡	●	...	...	...	...	...	...	✻	...	...	●	●	●▲Ψ	●
Dartmoor	...	●	●≡	●≡	●≡	...	...	...	...	●	●	≡	...	...	●	≡	≡	≡	●≡	...	...	●✻	...	●✻	●✻	●✻≡	●✻≡	●	●	●	...
Babbacombe	...	...	●	●	●	...	○Ψ	...	...	...	...	...	...	...	●○	●○	●≡	≡	●≡	...	○	...	✻	●✻	✻	●	●	●	●	●	○Ψ
Downside	...	●	●	●	...	...	Ψ	...	●	●	●	...	...	●✻	●	●	≡	≡	≡	...	●	●✻	...	...	●✻	●✻	✻	●	●	●▲	●
Marlborough	...	...	●	●Ψ	●	...	Ψ	...	...	●	...	...	●	●✻	●	●	...	●≡	≡	...	●	●✻	✻	...	●✻	✻	...	●	●▲	●	Ψ
Strathfield Turgiss	≡	...	●Ψ	Ψ	...	...	Ψ≡	≡	...	≡	...	...	...	●✻	...	...	●≡	●≡	≡	...	●	✻	✻	✻	●✻	✻≡	≡	●	●	●	...
Norwood	≡	≡	●Ψ	...	●	Ψ	≡	≡	...	●≡	...	...	≡	●✻	○	●	≡	●≡	○≡	≡	●≡	✻	✻	●✻	●✻▲	●✻	...	●	●▲	●Ψ	○Ψ
Croydon	...	●	●Ψ	...	●	...	...	...	...	●≡	...	...	...	●✻	...	●	...	●	...	...	✻	✻	✻	●✻	●✻	●✻	...	●	...	●Ψ	...
Bournemouth	...	...	●	●	●	...	...	...	...	...	...	...	...	...	●	●	≡	●≡	●	...	...	...	...	●	...	...	...	●	...	●	...
Eastbourne	≡	...	●	●	●	...	...	Ψ	...	●✻	...	...	...	...	●	...	...	●≡	...	...	...	...	...	✻	●✻	●	...	...	...	...	●
Ramsgate	●≡	...	●Ψ	...	●	...	...	...	...	...	●	...	...	●✻	...	...	...	...	...	...	...	...	...	✻▲	●✻	●✻	●	●	...	Ψ	...
Audley End	●≡	...	●Ψ	●	●	...	...	...	...	●	T	...	●	●✻	●	...	✻	●	...	...	●	●✻	✻	●	●✻	●✻	✻	●	●	●	●▲K
Hillington	...	...	●	...	●	...	...	...	...	●	...	...	●✻	●✻	●✻	●✻	...	●	...	●	...	...	...	...	●✻	●✻	●✻	●	●T	●Ψ	●▲K
Lowestoft	...	...	●	...	...	...	...	...	...	...	...	●	●✻	●✻	...	●	...	●	...	...	...	...	...	●	●	✻	...	●	●T	●	●≡

EXPLANATION OF THE SYMBOLS.—● indicates rain; ✻ snow; ▲ hail; ≡ fog; K thunderstorm; T thunder; < lightning; C solar halo; Ψ lunar halo.

List of the Stations, with the Names of the Observers, &c.

Station.	County.	Lat.	Long.	Above Sea.	Observer.
Audley End	Essex	52° 1′ N.	0°13′ E.	154ft.	J. Bryan.
Babbacombe	Devon	50 29	3 31 W.	293	E. E. Glyde, F.M.S.
Bournemouth (South Bourne)	Hants	50 44	1 48 W.	90	T.A.Compton,B.A.,M.D., F.M.S.
Buxton	Derby	53 14	1 54 W.	987	E. J. Sykes, F.R.A.S., F.M.S.
Carmarthen	Carmarthen	51 52	4 18 W.	188	G. J. Hearder, M.D.
Cheadle	Stafford	52 58	1 57 W.	646	J. C. Philips, J.P., F.M.S.
Cheltenham	Gloucester	51 54	2 3 W.	184	R. Tyrer, B.A., F M.S.
Chester	Cheshire	53 12	2 53 W.	63	A. O. Walker, F.L.S., F.M.S.
Churchstoke	Montgomery	52 31	3 5 W.	549	P. Wright, F.C.S., F.M.S.
Croydon(Addiscombe)	Surrey	51 23	0 4 W.	201	E. Mawley, F.M.S.
Dartmoor (Prince Town)	Devon	50 33	3 59 W.	1372	R. E. Power, L.R.C.P., F.M.S.
Downside	Somerset	51 15	2 29 W.	592	Rev.T.L.Almond,O.S.B., F.M.S.
Eastbourne	Sussex	50 46	0 16 E.	24	S. Bretton, F.M.S.
Gainford	Durham	54 33	1 44 W.	249	A. Atkinson.
Hillington	Norfolk	52 48	0 33 E.	88	Rev. H. E. B. Ffolkes, M.A., F.M.S.
Kelstern	Lincoln	53 24	0 7 W.	388	D. G. Briggs, F.M.S.
Llandudno	Carnarvon	53 21	3 50 W.	79	J. Nicol, M.D., F.M.S.
Lowestoft	Suffolk	52 29	1 45 E.	85	S. H. Miller, F.R.A.S., F.M.S.
Mansfield	Notts	53 8	1 12 W.	349	W. Tyrer, F.M.S.
Marlborough	Wilts	51 25	1 43 W.	471	Rev. T. A. Preston, M.A., F.M.S.
Norwood	Surrey	51 26	0 6 W.	184	W. Marriott, F.M.S.
Ramsgate	Kent	51 20	1 25 E.	105	Rev. E. A. D. O'Gara, O.S.B., F.M.S.
Scaleby	Cumberland	54 58	2 52 W.	111	B. A. Allison, F.M.S.
Shrewsbury (Leaton)	Salop	52 45	2 57 W.	266	Rev. E. V. Pigott, M.A., F.M.S.
Strathfield Turgiss	Hants	51 20	1 0 W.	195	Rev. C. H. Griffith, B.D., F.M.S.
Wakefield	Yorkshire	53 41	1 30 W.	96	H. Clarke, L.R.C.P., F.M.S.

Notes on the Tables.

Column 1 is the mean of the readings of the Barometer at 9 a.m. and 9 p.m. corrected for temperature and reduced to sea-level.

Column 4 is the mean of the readings of the Dry-Bulb Thermometer at 9 a.m. and 9 p.m.

Columns 5 to 10. The Maximum and Minimum Thermometers are read and set at 9 p.m., and the readings entered to the same day.

Columns 13 and 14. The Relative Humidity is calculated by dividing the elastic force of vapour, at the temperature of the dew-point, for the month, by that at the temperature of the air (*i.e.* dry-bulb reading).

Columns 15 and 16. The Amount of Cloud is estimated according to the scale 0—10, 0 representing a cloudless sky, and 10 a completely covered or overcast sky.

Columns 17 to 20. The Rain is measured at 9 a.m., and the amount entered to the previous day. A fall of ·006 in. and above constitutes a day of *rain.*

Column 21. When any Snow falls it is entered as a day of *snow.*

Columns 22 and 23. When the mean of the 9 a.m. and 9 p.m. observations of the amount of Cloud is less than 2·0, this is called a day of *clear sky*, but when the mean is above 8·0 it is called an *overcast* day.

Column 24. When the Force of the Wind is 7 and above (on the scale 0—12) this is counted as a *gale.*

Columns 25 to 33 give the sums of the observations of the Direction of the Wind at 9 a.m. and 9 p.m.

Report on the Meteorology of England for the Quarter ending JUNE 30TH, 1879, *with Monthly Abstracts of Observations made at the Society's Stations.* By WILLIAM MARRIOTT, Assistant-Secretary.

ATMOSPHERIC PRESSURE throughout the quarter was below the average.

In *April* the mean pressure, reduced to sea level, was 29·71 ins. The highest readings were in the central and north-eastern districts, and the lowest in the south. The maximum occurred on the 29th, the highest reported being 30·384 ins. at 9 p.m. at Churchstoke. The minimum took place on the 7th, the lowest recorded being 28·726 ins. at 9 a.m. at Carmarthen.

In *May*, the pressure was in excess, and much more uniform than that of the previous month, the mean being 30·02 ins. The highest readings were in the south and west, and the lowest in the north and north-east. The maximum occurred on the 4th, the highest being 30·581 ins. at 9 p.m. at Buxton. The minimum took place on the 26th, 27th, 28th, 29th, 30th, and 31st, the lowest reported being 29·437 ins. at 11.50 p.m., on the 27th, at Babbacombe.

In *June* the pressure was deficient, the mean being 29·79 ins. The highest readings were in the south-east, and the lowest in the north. The maximum occurred generally on the evening of the 13th, the highest being 30·196 ins. at Kelstern. The minimum took place in the SE on the 3rd, in the SW on the 17th, and in the NW on the 21st, the lowest being 29·382 ins. at 9 p.m. on the 21st at Scaleby.

AIR TEMPERATURE continued much below the average.

In *April* the mean* was 41°·7, and varied from 43°·8 at Babbacombe, Ramsgate, and Strathfield Turgiss, to 38°·1 at Buxton. With the exception of the 7th, 8th, and 26th, the weather was cold throughout the month, the 11th to the 14th being excessively so. The maximum temperature took place on various dates, but chiefly on the 26th, the highest reported being 61°·5 on the 27th at Hillington. The minimum was registered in the SE on the 12th, and generally in the N and W on the 13th, the lowest being 19°·1 at Shrewsbury on the 13th. The mean daily range was 13°·6.

In *May* the mean temperature was 47°·3, and varied from 49°·2 at Eastbourne to 43°·1 at Dartmoor. With the exception of the 5th, 20th, 21st, and 22nd, the weather was wet and chilly, the 7th, 8th, and 10th being bitterly cold. The maximum temperature occurred in the central districts on the 21st, but on various dates at other places, the highest recorded being 70°·4 on the 21st at Hillington. The minimum took place on the 3rd, 8th, and over the central districts generally on the 10th, the lowest registered being 23°·0 on the 10th at Buxton. The mean daily range was, owing to the cloudy state of the sky, only 15°·4.

In *June* the mean temperature was 54°·8, and varied from 56°·8 at Norwood to 49°·8 at Dartmoor, and 51°·9 at Buxton; the weather throughout the whole of the month was dull, cold, and wet. The maximum temperature occurred generally on the 13th, 14th, 18th, 19th, and 20th, the highest being 75°·2 at Ramsgate on the 11th. The minimum took place in the S and W on the 4th, and in the N on the 5th, the lowest being 35°·2 on the 4th at Cheltenham, and 35°·0 on the 5th at Churchstoke. Owing to the absence of sun, the daily range was very small, the mean being only 13°·6.

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* The mean of the 9 a.m. and 9 p.m. dry bulb readings.

The Rainfall was in excess of the average.

In *April* it was large in the S and SW, but moderate in the N. The falls varied from 5·24 ins. at Dartmoor to 1·13 in. at Scaleby. The greatest daily falls occurred on various dates; the heaviest recorded amount was 1·16 in. at Eastbourne on the 15th. Snow fell generally from the 12th to the 15th. Thunderstorms prevailed in the N on the 26th, and in the W and SW on the 27th.

In *May* the number of rainy days was great in the SW, but comparatively small in the N and E; the rainfall also was slightly above the average. The falls varied from 4·73 ins. at Dartmoor, and 4·26 ins. at Kelstern, to 1·35 in. at Gainford, and 1·45 in. at Bournemouth. Snow fell generally on the 1st and 7th. Hail and thunderstorms also occurred on several occasions.

In *June* the rainfall was greatly in excess of the average; the number of rainy days at most places was also very great. The monthly falls varied from 15·89 ins. at Dartmoor, 8·91 ins. at Carmarthen, and 7·34 ins. at Babbacombe, to 2·10 ins. at Lowestoft. The greatest daily falls took place on the 7th in the N, and generally on the 30th in other places, the heaviest being 2·89 ins. at Dartmoor on the 30th. Thunderstorms occurred on several occasions, chiefly from the 8th to the 13th, and on the 24th and 25th.

Wind.—In *April* the direction was variable. Gales blew at a few places on the 6th, 10th, and 13th. In *May* the general direction was NE till the 10th, SW and NW till the 26th, NE till the 29th, and S till the 31st. The wind was strong in force, and blew a gale on one or two occasions. In *June* SW winds prevailed generally throughout the month, and blew a gale at several places on the 12th, 21st, 27th, and 28th.

Notes by the Observers.

Babbacombe, *April*.—A cold, wet, and winterly month; in fact, the sixth month of the prolonged winter. Frost occurred on three nights in the air, and twenty nights on the grass, including almost every night in the first three weeks. Very cold weather with sleet and snow prevailed from the 12th to the 15th.

May.—A cold, showery, ungenial month; the 1st, 2nd, and 7th were bitterly cold. The temperature only rose above 60° on three days, viz. 5th, 21st, and 22nd. Vegetation was very backward till the middle of the month, when it advanced rapidly.

June.—The month has been excessively wet, damp, cold, gloomy, and windy; more like November than June. The rainfall, 7·34 ins., was more than quadruple the average for this locality for 15 years past, and much greater than any observed in June during that time. The sea-temperature was uniformly low, ranging in the bi-weekly observations from 51°·2 to 52°·0 only.

Bournemouth.—The total duration of sunshine was in April 102·4 hours; May 175·1 hours; and June 121·9 hours.

June.—The most unsettled, windy, wet, cloudy, chilly June I have ever egistered in this district during 18 years' observations. The lowness of maxima temperatures very remarkable, only eleven days above 60°. Mean aily range very small, and about equal to that of December in this district. n the very cold June of 1871 my mean maximum here was 61°·9, or 2°·5 warmer than in June 1879.

CHELTENHAM, *April.*—Heavy snow on morning of the 12th, and during he day. First swallow seen on 20th, and cuckoo heard on 27th.

May.—Walnut trees killed by frost of 10th; on the 31st still black and eafless.

June.—Vegetation much behind. Strawberries ripe on the 29th, currants ust red. Gooseberry and currant trees stripped by the larva of the goose- erry saw-fly.

CROYDON, *April.*—Remarkable as being the sixth cold month in succession, nd for the absence of any unseasonably warm days.

May.—Single gorse came into blossom in my garden on the 8th, an espa- er pear-tree and a Morello cherry on a north wall on the 12th, and an spalier apple-tree on the 19th. NE winds prevailed for 268 hours.

June.—Remarkable as being the eighth month in succession of unseasonably cold weather, for the absence of any warm days, and for the general lowness f atmospheric pressure. The number of hours of SW winds was 201, and of SSW winds 224. On the 10th I cut my first rose, just three weeks later than ast year. As in last month, the rose-plants were singularly free from aphis.

HILLINGTON, *May.*—The wettest May for 18 years, except 1869 and 878, 3·24 ins. and 3·94 ins. respectively. A chilly, sunless month. Vege- ation nearly a month in arrear. No "may." Oaks and ash only beginning o show leaf. Other foliage good.

June.—The greatest June rainfall for many years. The mean of 18 years, 866-1878, 1·94 in. The next in order of excess is 1871, with 2·90 ins. A sunless, wet month.

LOWESTOFT, *June* 29th.—Very sudden squalls (8) from WSW at 6 p.m. mmense clouds of dust, moving with a rotatory motion of considerable elocity. Large quantities of small hail and slight rain from 6 to 6.45 p.m. Barometer fell from 29·95 ins. to 29·93 ins. during passage of squall, but ising again at 9 p.m. Temperature fell considerably just before squall.

MARLBOROUGH, *May* 1st.—Snow from 7 a.m. to 1 p.m., rain, showery. This was the heaviest fall of snow of the season. There was rain at first, ut shortly after 7 it turned to snow, the flakes very large. The snow fell ontinuously till nearly 1 p.m., then turned to rain. For some time the now melted as soon as it touched the ground, but at about 8 a.m. the round began to whiten, and soon the whole country was covered. At Swin- on from 2 to 3 feet is the estimated depth of the snow; I should say about foot fell at Marlborough.

SHREWSBURY, *April* 11th-14th.—Snow began to fall on night of the 11th; t 9 a.m. on 12th 7½ ins. Snowed all day. During night of 12th ther- mometer fell to 19°·1. Through 13th snow continued mixed with rain. On 4th began to thaw rapidly.

Abstract of Meteorological Observations for the Month of May, 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.			Air Temperature. Means of		Air Temperature. Absolute Min. and Max.				Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.	Rainfall. Greatest Fall in 24 hours.		Weather, No. of days of					Wind, No. of Observations of								
		9 a.m.	9 p.m.	Mean.	Min.	Max.	Min.	Date.	Max.	Date.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Total Fall.	Amnt.	Date.	Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	29·997	49·2	45·3	47·2	38·5	55·6	27·0	2	64·2	29	46·5	44·1	81	90	6·7	5·8	1·98	·54	29	15	1	5	12	1	9	4	8	1	2	11	11	1	15
Gainford	30·006	48·4	45·1	46·8	38·8	55·7	29·4	10	67·2	5	44·5	43·1	73	85	6·8	6·5	1·35	·22	31	15	4	3	13	1	6	9	3	3	4	14	5	11	7
Wakefield	·008	48·4	47·3	47·8	39·5	55·6	27·0	3	64·8	21	45·3	45·0	78	83	7·5	6·6	2·00	·42	29	16	0	3	14	0	10	8	6	7	4	4	15	8	0
Kelstern	·014	47·3	43·3	45·3	38·1	54·0	28·7	10	66·5	21	44·6	42·2	80	91	7·1	6·3	4·26	·83	14	18	2	6	14	0	8	12	5	9	9	9	3	7	0
Mansfield	·010	47·4	45·7	46·5	39·5	55·2	25·8	10	66·4	5	44·4	43·9	78	87	7·3	5·2	3·64	·76	15	17	3	4	12	0	12	7	4	2	4	9	5	4	15
Buxton	·032	46·7	42·4	44·6	37·0	53·0	23·0	10	63·1	21	43·6	40·7	78	86	7·6	6·6	3·45	·64	31	20	3	0	12	0	4	6	10	5	1	10	11	13	2
Cheadle	·020	46·0	45·0	45·5	39·2	53·2	28·0	10	61·2	21	43·1	42·8	79	84	7·4	5·5	2·49	·31	31	15	4	3	11	0	7	6	7	3	1	9	5	11	13
Llandudno	·030	49·6	47·5	48·5	43·1	53·8	32·6	7	59·8	3	46·3	44·9	77	81	5·8	6·1	1·88	·27	31	12	1	8	12	0	15	1	17	0	3	1	14	10	1
Chester	·007	49·8	47·2	48·5	40·9	56·2	29·7	3	64·0	31	45·4	44·6	71	81	..	..	2·08	·48	14	17	1	..	..	2	21	9	4	0	10	2	4	7	5
Shrewsbury (Leaton)	·029	49·4	46·0	47·7	38·8	56·0	25·5	5	66·3	31	46·1	44·5	77	88	6·5	6·0	1·65	·36	28	21	1	5	13	0	19	1	3	2	1	4	9	6	17
Churchstoke	·043	47·8	45·8	46·8	38·7	54·7	28·0	3	63·1	5	44·9	44·0	79	87	6·5	7·5	2·23	·56	14	21	2	0	8	0	19	2	6	0	9	10	9	7	0
Cheltenham	·014	49·4	47·1	48·3	39·2	56·8	23·4	10	68·0	21	46·6	45·3	80	86	7·7	6·8	2·80	1·00	28	21	1	1	12	1	15	2	2	3	10	10	11	8	1
Carmarthen	·026	50·8	46·3	48·6	41·6	56·2	29·4	3	65·8	19	46·8	44·4	74	86	6·9	6·1	3·14	·81	28	19	1	4	13	0	26	1	9	3	6	4	7	3	3
Dartmoor	·030	44·2	42·1	43·1	38·3	49·1	27·5	8	59·0	5	42·3	40·9	85	90	6·7	6·7	4·73	·89	30	26	7	3	14	5	7	7	9	8	4	6	9	10	2
Babbacombe	·030	49·6	46·9	48·2	43·1	55·3	35·0	2, 8	63·0	22	46·4	44·7	78	84	6·6	6·6	2·19	·86	27	23	1	3	10	1	6	13	3	4	4	15	4	13	0
Downside	·020	47·5	45·0	46·3	40·2	54·8	29·0	8	63·3	5, 21	44·6	43·5	79	89	7·3	6·5	3·33	·79	27	21	2	3	16	1	3	16	2	3	5	17	5	10	1
Marlborough	·033	48·7	46·3	47·5	40·0	57·0	27·6	10	66·3	20, 21	45·0	44·1	75	83	7·8	6·0	3·45	1·33	28	19	2	3	15	0	11	6	0	0	4	8	3	10	20
Strathfield Turgiss	·022	50·4	46·8	48·6	39·2	57·8	23·6	3	69·0	24	46·5	44·3	74	82	7·7	6·0	3·58	1·43	28	15	1	4	13	0	8	8	2	8	2	14	7	12	1
Norwood	·010	50·2	46·5	48·4	40·2	56·9	28·5	3	67·2	24	46·5	44·2	75	83	7·6	4·1	3·45	1·48	28	17	2	4	9	0	10	12	5	3	5	6	6	8	7
Croydon	30·020	49·8	46·1	48·0	40·3	56·3	29·2	10	66·6	20	45·6	43·5	72	81	8·1	4·2	3·68	1·55	28	17	1	2	9	0	6	10	4	4	10	11	7	3	7
Bournemouth	29·993	49·5	47·0	48·2	41·9	54·8	29·9	8	64·3	5	46·1	44·7	77	83	5·6	5·9	1·45	·42	27	17	0	4	9	0	9	11	5	6	4	11	8	8	0
Eastbourne	30·009	51·0	47·3	49·2	41·4	57·2	28·8	8	66·7	22	47·4	45·0	76	83	5·9	4·8	2·10	·96	28	19	2	6	6	2	2	6	11	4	0	5	14	19	1
Ramsgate	·029	50·9	46·0	48·4	42·0	57·3	34·6	1	68·4	21	47·3	44·2	76	86	7·1	5·2	3·29	1·25	23	12	1	1	7	1	12	9	3	3	3	13	6	2	11
Audley End	30·003	49·2	44·5	46·8	38·3	55·8	25·0	10	66·0	21	45·6	42·9	75	87	7·2	4·5	2·86	·50	15	19	2	2	10	0	4	14	0	7	1	16	1	18	1
Hillington	29·997	50·8	44·9	47·8	38·8	57·2	25·9	4	70·4	21	47·3	43·5	77	89	7·3	7·1	3·15	·76	14	19	1	1	14	0	6	16	1	12	2	14	2	9	0
Lowestoft	29·986	49·3	44·8	47·1	40·5	53·2	31·3	1	61·2	22	45·8	43·0	76	86	7·3	5·3	1·88	·69	23	13	1	2	11	0	5	20	3	2	9	16	3	4	0
Columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Scaleby	●✱	...	...	...	●	...	...	...	...	●	●	...	...	...	...	...	●T	...	...	●	...	...	●	●	●	●	●	●	●	●	●
Gainford ..	●✱▲	...	≡	≡	...	✱▲	●✱	●	●✱	≡	●	...	...	●	●	≡	●≡K	●≡	≡	●≡	≡	●	...	●	...	...	●≡	...	●≡	≡	●
Wakefield ..	●	...	...	...	●	...	...	●	...	...	●	...	...	●	●	...	●	●	...	●	●	●	...	●	●	●	...	...	●	...	●
Kelstern	...	...	...	...	●	●✱	●✱▲	●▲	●	...	●	●	●K	●≡	●≡	≡	≡	...	●≡	●	...	●	...	●	...	●T	≡	●≡	●≡	...	●≡○
Mansfield ..	✱	...	...	...	...	✱	✱▲	●	●	...	●	●	...	●T	●	...	●	●	...	●	...	●	●	●	...	●K	●	●	●	...	●
Buxton	✱	...	...	...	●	●▲	●✱	●✱	...	●	●	●	K	●	●	...	●	●	●	●	...	●	...	●	●	●	...	●	●	...	●
Cheadle	✱▲T	...	▲	...	●▲	...	✱	●	✱	●✱▲	●▲K	...	...	●T	●	...	●▲	●	...	...	...	●	...	●	●▲	●T	...	●	●	...	●
Llandudno ..	✱	...	...	...	...	▲	...	●	...	...	...	...	...	...	...	●	●	...	≡	●	...	●	●	●	●	●	...	●	●	...	●
Chester	✱	...	...	...	●	...	...	●	...	●	●	...	●	●	...	...	●	●	●	●	...	●	...	●	●	●	...	●	●	●	...
Shrewsbury	●	...	...	...	●	...	✱	●	●	●	...	...	●	●	●	...	●	●≡	●≡	●	...	●	●	●	●	●	●	●	●	...	●≡
Churchstoke	●✱	...	...	≡	●≡	●▲	✱≡	●	...	≡	●	...	●≡	●	●	≡	●≡	●≡	●≡	●≡	≡	●≡	●	●≡	...	●≡	●≡	●≡	●≡	●▲≡	●
Cheltenham	●▲	...	...	...	●	...	✱	●	●	●	●	●	●	●	●	●	●	●	●	...	●	●	...	●	...	●	●	●	...	...	●
Carmarthen	...	...	...	...	...	...	●✱▲	●	...	●	●	●	●	●	...	●	●	●	...	●≡	...	●	●	●≡	...	●	●	●	...	●	●
Dartmoor ..	●✱	...	...	...	●	●✱≡	✱	●	●	●✱	●✱≡	●▲<	●≡<	●▲	...	●	●	●≡	●≡	●≡	●≡	●	●	●≡	●	●≡	●✱	●✱	●	●	●
Babbacombe	●	...	...	...	●	●	✱	●	●▲○	●	●	●	●	●▲	...	●○	●≡	●	...	●≡	●≡	≡	●○	●≡	...	●	●	●	●	●	●T
Downside ..	●✱	...	...	...	●	...	✱	●	●	...	●	●≡	●	●	●	...	●	●	T	●	...	●	●	●	...	●	●	●	●	●	●
Marlborough	●✱	...	...	...	●	...	●✱	●	...	●	●	...	●	●	●	...	●	●	...	...	●	●	...	●	...	●	●	●▲	...	●	●
Strathfield T.	●✱	...	...	...	●	...	▲	●	...	...	●	≡	≡	●K	●	≡	●	●	≡	...	...	●	...	●	...	●	●	●	...	●	●
Norwood	●	▲	≡	...	●≡	●≡	✱▲	●	...	✱	●	≡○	○	●▲T	●	≡	●○	●	≡	≡	...	●	●▲	●≡	●	●	●<	●K	K	...	●
Croydon	●▲	...	...	...	●	●	✱	●	...	...	●	...	●	●▲	●	...	●	●	...	...	...	●	●	●	...	●	●	●K	K	...	●
Bournemouth	●	...	...	...	●	●	...	●	●	...	●	●	●	●	...	...	●≡	≡	...	...	≡	●≡	...	●	...	●	●	●	...	●	●
Eastbourne	✱	...	...	...	...	●	●✱▲	●	●	...	●	...	●	●	...	...	●	●	●T	...	...	●	●	●	●	●	●	●	...	●	●
Ramsgate ..	▲	...	...	...	...	●	●✱▲	...	...	▲	...	...	●	●	●▲	...	...	●	●	T≡	...	●	●	...	●	...	●	●	...	...	...
Audley End	●✱▲	...	...	...	●	●▲	●✱▲	...	...	...	●	...	●	●T	●	●≡	●≡	●	...	●	...	●	●	●	●	●	●	●	K	...	...
Hillington ..	●▲	...	...	...	●	●▲	●✱▲	▲	...	...	●	...	●	●▲K	●	...	●	...	...	●	...	●	●	●	●▲	●	●T	●	...	●	●▲K
Lowestoft ..	...	...	...	...	●	●	●✱▲	▲	...	...	●	...	●≡	●	●	...	...	...	...	...	...	●	●	●	●	...	...	●	...	...	●

EXPLANATION OF THE SYMBOLS.—● indicates rain; ✱ snow; ▲ hail; ≡ fog; K thunderstorm; T thunder; < lightning; ○ solar halo; Ш lunar halo

Abstract of Meteorological Observations for the Month of May, 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
					Means of		Absolute Min. and Max.											Greatest Fall in 24 hours.															
		9 a.m.	9 p.m.	Mean.	Min.	Max.	Min.	Date.	Max.	Date.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Total Fall.	Amnt.	Date.	Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	29·997	49·2	45·3	47·2	38·5	55·6	27·0	2	64·2	29	46·5	44·1	81	90	6·7	5·8	1·98	·54	29	15	1	5	12	1	9	4	8	1	2	11	11	1	15
Gainford	30·006	48·4	45·1	46·8	38·8	55·7	29·4	10	67·2	5	44·5	43·1	73	85	6·8	6·5	1·35	·22	31	15	4	3	13	1	6	9	3	3	4	14	5	11	7
Wakefield..........	·008	48·4	47·3	47·8	39·5	55·6	27·0	3	64·8	21	45·3	45·0	78	83	7·5	6·6	2·00	·42	29	16	0	3	14	0	10	8	6	7	4	4	15	8	0
Kelstern	·014	47·3	43·3	45·3	38·1	54·0	28·7	10	66·5	21	44·6	42·2	80	91	7·1	6·3	4·26	·83	14	18	2	6	14	0	8	12	5	9	9	9	3	7	0
Mansfield	·010	47·4	45·7	46·5	39·5	55·2	25·8	10	66·4	5	44·4	43·9	78	87	7·3	5·2	3·64	·76	15	17	3	4	12	0	12	7	4	2	4	9	5	4	15
Buxton	·032	46·7	42·4	44·6	37·0	53·0	23·0	10	63·1	21	43·6	40·7	78	86	7·6	6·6	3·45	·64	31	20	3	0	12	0	4	6	10	5	1	10	11	13	2
Cheadle.	·020	46·0	45·0	45·5	39·2	53·2	28·0	10	61·2	21	43·1	42·8	79	84	7·4	5·5	2·49	·31	31	15	4	3	11	0	7	6	7	3	1	9	5	11	13
Llandudno	·030	49·6	47·5	48·5	43·1	53·8	32·6	7	59·8	3	46·3	44·9	77	81	5·8	6·1	1·88	·27	31	12	1	8	12	0	15	1	17	0	3	1	14	10	1
Chester	·007	49·8	47·2	48·5	40·9	56·2	29·7	3	64·0	31	45·4	44·6	71	81	..	..	2·08	·48	14	17	1	..	..	2	21	9	4	0	10	2	4	7	5
Shrewsbury (Leaton)	·029	49·4	46·0	47·7	38·8	56·0	25·5	5	66·3	31	46·1	44·5	77	88	6·5	6·0	1·65	·36	28	21	1	5	13	0	19	1	3	2	1	4	9	6	17
Churchstoke...... ..	·043	47·8	45·8	46·8	38·7	54·7	28·0	3	63·1	5	44·9	44·0	79	87	6·5	7·5	2·23	·56	14	21	2	0	8	0	19	2	6	0	9	10	9	7	0
Cheltenham	·014	49·4	47·1	48·3	39·2	56·8	23·4	10	68·0	21	46·6	45·3	80	86	7·7	6·8	2·80	1·00	28	21	1	1	12	1	15	2	2	3	10	10	11	8	1
Carmarthen	·026	50·8	46·3	48·6	41·6	56·2	29·4	3	65·8	19	46·8	44·4	74	86	6·9	6·1	3·14	·81	28	19	1	4	13	0	26	1	9	3	6	4	7	3	3
Dartmoor	·030	44·2	42·1	43·1	38·3	49·1	27·5	8	59·0	5	42·3	40·9	85	90	6·7	6·7	4·73	·89	30	26	7	3	14	5	7	7	9	8	4	6	9	10	2
Babbacombe........	·030	49·6	46·9	48·2	43·1	55·3	35·0	2, 8	63·0	22	46·4	44·7	78	84	6·6	6·6	2·19	·86	27	23	1	3	10	1	6	13	3	4	4	15	4	13	0
Downside	·020	47·5	45·0	46·3	40·2	54·8	29·0	8	63·3	5, 21	44·6	43·5	79	89	7·3	6·5	3·33	·79	27	21	2	3	16	1	3	16	2	3	5	17	5	10	1
Marlborough	·033	48·7	46·3	47·5	40·0	57·0	27·6	10	66·3	20, 21	45·0	44·1	75	83	7·8	6·0	3·45	1·33	28	19	2	3	15	0	11	6	0	0	4	8	3	10	20
Strathfield Turgiss..	·022	50·4	46·8	48·6	39·2	57·8	23·6	3	69·0	24	46·5	44·3	74	82	7·7	6·0	3·58	1·43	28	15	1	4	13	0	8	8	2	8	2	14	7	12	1
Norwood	·010	50·2	46·5	48·4	40·2	56·9	28·5	3	67·2	24	46·5	44·2	75	83	7·6	4·1	3·45	1·48	28	17	2	4	9	0	10	12	5	3	5	6	6	8	7
Croydon	30·020	49·8	46·1	48·0	40·3	56·3	29·2	10	66·6	20	45·6	43·5	72	81	8·1	4·2	3·68	1·55	28	17	1	2	9	0	6	10	4	4	10	11	7	3	7
Bournemouth	29·993	49·5	47·0	48·2	41·9	54·8	29·9	8	64·3	5	46·1	44·7	77	83	5·6	5·9	1·45	·42	27	17	0	4	9	0	9	11	5	6	4	11	8	8	0
Eastbourne	30·009	51·0	47·3	49·2	41·4	57·2	28·8	8	66·7	22	47·4	45·0	76	83	5·9	4·8	2·10	·96	28	19	2	6	6	2	2	6	11	4	0	5	14	19	1
Ramsgate	·029	50·9	46·0	48·4	42·0	57·3	34·6	1	68·4	21	47·3	44·2	76	86	7·1	5·2	3·29	1·25	23	12	1	1	7	1	12	9	3	3	3	13	6	2	11
Audley End	30·003	49·2	44·5	46·8	38·3	55·8	25·0	10	66·0	21	45·6	42·9	75	87	7·2	4·5	2·86	·50	15	19	2	2	10	0	4	14	0	7	1	16	1	18	1
Hillington	29·997	50·8	44·9	47·8	38·8	57·2	25·9	4	70·4	21	47·3	43·5	77	89	7·3	7·1	3·15	·76	14	19	1	1	14	0	6	16	1	12	2	14	2	9	0
Lowestoft	29·986	49·3	44·8	47·1	40·5	53·2	31·3	1	61·2	22	45·8	43·0	76	86	7·3	5·3	1·88	·69	23	13	1	2	11	0	5	20	3	2	9	16	3	4	0
Columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Scaleby	●✱	...	...	...	●	...	...	...	...	●	●	...	...	...	...	...	●T	...	...	●	...	...	●	●	●	●	●	●	●	●	●
Gainford ..	●✱▲	...	≡	≡	...	✱▲	●✱	●	●✱	≡	●	...	...	●	●	≡	●≡Ʀ	●≡	≡	●≡	≡	●	...	●	...	...	●≡	...	●≡	≡	●
Wakefield ..	●	...	...	...	●	...	...	●	...	...	●	...	...	●	●	...	●	●	...	●	●	●	...	●	●	●	...	...	●	...	●
Kelstern	...	...	...	...	●	●✱	●✱▲	●▲	●	...	●	●	●Ʀ	●≡	●≡	≡	≡	...	●≡	●	...	●	...	●	...	●T	≡	●≡	●≡	...	●≡○
Mansfield ..	✱	...	...	...	...	✱	✱▲	●	●	...	●	●	...	●T	●	...	●	●	...	●	...	●	●	●	...	●Ʀ	●	●	●	...	●
Buxton	✱	...	...	...	●	●▲	●✱	●✱	...	●	●	●	Ʀ	●	●	...	●	●	●	●	...	●	...	●	●	●	...	●	●	...	●
Cheadle	✱▲T	...	▲	...	●▲	...	✱	●	✱	●✱▲	●▲Ʀ	...	...	●T	●	...	●▲	●	...	...	...	●	...	●	●▲	●T	...	●	●	...	●
Llandudno ..	✱	...	...	...	...	▲	...	●	...	...	...	...	...	...	...	●	●	...	≡	●	...	●	●	●	●	●	...	●	●	...	●
Chester	✱	...	...	...	●	...	...	●	...	●	●	...	●	●	...	...	●	●	●	●	...	●	...	●	●	●	...	●	●	●	...
Shrewsbury	●	...	...	...	●	...	✱	●	●	●	...	...	●	●	●	...	●	●≡	●≡	●	...	●	●	●	●	●	●	●	●	...	●≡
Churchstoke	●✱	...	...	≡	●≡	●▲	✱≡	●	...	≡	●	...	●≡	●	●	≡	●≡	●≡	●≡	●≡	≡	●≡	●	●≡	...	●≡	●≡	●≡	●≡	●▲≡	●
Cheltenham	●▲	...	...	...	●	...	✱	●	●	●	●	●	●	●	●	●	●	●	●	...	●	●	...	●	...	●	●	●	...	...	●
Carmarthen	...	...	...	...	...	...	●✱▲	●	...	●	●	●	●	●	...	●	●	●	...	●≡	...	●	●	●≡	...	●	●	●	...	●	●
Dartmoor ..	●✱	...	...	...	●	●✱≡	✱	●	●	●✱	●✱≡	●▲<	●≡<	●▲	...	●	●	●≡	●≡	●≡	●≡	●	●	●≡	●	●≡	●✱	●✱	●	●	●
Babbacombe	●	...	...	...	●	●	✱	●	●▲○	●	●	●	●	●▲	...	●○	●≡	●	...	●≡	●≡	≡	●○	●≡	...	●	●	●	●	●	●T
Downside ..	●✱	...	...	...	●	...	✱	●	●	...	●	●≡	●	●	●	...	●	●	T	●	...	●	●	●	...	●	●	●	●	●	●
Marlborough	●✱	...	...	...	●	...	●✱	●	...	●	●	...	●	●	●	...	●	●	...	...	●	●	...	●	...	●	●	●▲	...	●	●
Strathfield T.	●✱	...	...	...	●	...	▲	●	...	...	●	≡	≡	●Ʀ	●	≡	●	●	≡	...	...	●	...	●	...	●	●	●	...	●	●
Norwood	●	▲	≡	...	●≡	●≡	✱▲	●	...	✱	●	≡○	○	●▲T	●	≡	●○	●	≡	≡	...	●	●▲	●≡	●	●	●<	●Ʀ	Ʀ	...	●
Croydon	●▲	...	...	...	●	●	✱	●	...	...	●	...	●	●▲	●	...	●	●	...	...	...	●	●	●	...	●	●	●Ʀ	Ʀ	...	●
Bournemouth	●	...	...	...	●	●	...	●	●	...	●	●	●	●	...	...	●≡	≡	...	...	≡	●≡	...	●	...	●	●	●	...	●	●
Eastbourne	✱	...	...	...	...	●	●✱▲	●	●	...	●	...	●	●	...	...	●	●	●T	...	...	●	●	●	●	●	●	●	...	●	●
Ramsgate ..	▲	...	...	...	...	●	●✱▲	...	...	▲	...	...	●	●	●▲	...	...	●	●	T≡	...	●	●	...	●	...	●	●	...	...	...
Audley End	●✱▲	...	...	...	●	●▲	●✱▲	...	...	...	●	...	●	●T	●	●≡	●≡	●	...	●	...	●	●	●	●	●	●	●	Ʀ	...	...
Hillington ..	●▲	...	...	...	●	●▲	●✱▲	▲	...	...	●	...	●	●▲Ʀ	●	...	●	...	...	●	...	●	●	●	●▲	●	●T	●	...	●	●▲Ʀ
Lowestoft ..	...	...	...	...	●	●	●✱▲	▲	...	...	●	...	●≡	●	●	...	...	...	...	...	...	●	●	●	●	...	...	●	...	...	●

EXPLANATION OF THE SYMBOLS. ● indicates rain; ✱ snow; ▲ hail; ≡ fog; Ʀ thunderstorm; T thunder; < lightning; ○ solar halo; Ɯ lunar halo

Abstract of Meteorological Observations for the Month of June, 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
					Means of		Absolute Min. and Max.										Total Fall.	Greatest Fall in 24 hours.															
		9 a.m.	9 p.m.	Mean.	Min.	Max.	Min.	Date.	Max.	Date.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.		Amnt.	Date.	Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	29·705	56·5	52·9	54·7	47·3	62·1	36·0	5	70·2	19	53·2	51·0	80	87	8·2	7·3	4·40	·87	7	21	0	0	16	1	4	3	11	3	3	19	8	0	9
Gainford	·736	56·0	52·7	54·3	47·8	63·1	37·8	2, 5	70·2	19	52·4	50·7	78	86	8·0	6·7	3·60	·98	7	19	0	0	15	0	1	8	2	11	9	11	3	6	9
Wakefield	·746	55·9	54·7	55·3	48·9	62·6	38·1	5	69·0	19	52·7	52·5	80	86	7·9	6·1	3·79	·95	7	22	0	0	10	0	2	7	6	6	10	13	12	4	0
Kelstern	·778	55·2	52·0	53·6	46·6	61·7	36·9	5	68·6	20	52·3	50·2	81	88	7·6	5·7	4·01	·86	7	20	0	1	8	0	1	4	4	5	8	27	7	2	2
Mansfield	·769	55·5	53·0	54·3	48·2	62·4	36·1	5	69·7	20	52·9	51·4	83	89	7·5	6·1	4·77	·76	7	23	0	1	12	0	2	1	8	3	16	13	10	0	7
Buxton	·787	53·3	50·6	51·9	46·3	59·6	37·8	19	65·3	20	50·3	49·0	80	89	8·5	7·9	6·61	1·05	7	25	0	0	18	0	3	1	4	11	1	18	15	6	1
Cheadle	·757	53·4	52·0	52·7	47·0	60·1	39·1	4	65·3	14	51·1	50·3	84	88	8·0	6·5	6·40	1·25	7	24	0	0	11	6	3	2	6	9	16	14	3	4	3
Llandudno	·729	56·5	53·9	55·2	50·8	61·0	41·8	5	67·8	19	53·4	51·9	80	87	8·0	7·4	3·25	·80	7	18	0	1	15	0	7	0	9	1	8	6	20	9	0
Chester	·735	57·2	54·5	55·8	49·3	64·0	41·5	4	71·1	20	53·1	51·8	75	83	..	..	4·26	1·32	11	25	0	..	..	0	6	1	2	4	17	16	6	5	3
Shrewsbury (Leaton)	....	56·1	53·0	54·6	47·2	63·1	39·0	2	68·1	14,17	54·0	52·0	86	93	..	..	5·42	1·13	7	25	0	..	..	0	1	2	2	5	8	6	19	2	15
Churchstoke	·776	54·9	52·9	53·9	47·2	61·3	35·0	5	65·1	13,14	52·1	51·3	82	89	7·0	7·3	4·76	·68	7	24	0	0	7	0	1	1	6	9	15	16	9	3	0
Cheltenham	·781	57·6	54·3	55·9	48·5	64·1	35·2	4	68·8	13	55·2	52·7	85	89	8·2	7·3	4·34	·82	30	26	0	0	14	2	2	0	1	4	24	9	17	3	0
Carmarthen	·753	56·6	52·8	54·7	49·1	62·2	37·1	2	67·9	5	53·7	51·5	82	91	8·2	7·6	8·91	1·53	30	23	0	0	19	2	4	0	5	9	7	19	5	5	6
Dartmoor	·795	50·6	48·9	49·8	45·9	54·2	41·0	4	59·2	18	49·7	48·5	93	97	8·7	9·2	15·89	2·89	30	29	0	0	21	5	0	1	1	5	10	11	18	11	3
Babbacombe	·805	56·4	52·5	54·5	50·2	61·2	41·9	4	69·2	18	54·1	51·4	85	92	7·9	7·3	7·34	1·53	30	26	0	0	14	4	1	3	1	4	12	27	11	1	0
Downside	·791	54·8	51·8	53·3	48·8	60·5	40·8	4	66·8	13	52·1	50·3	83	90	8·1	6·9	6·05	1·10	30	25	0	0	14	3	0	2	2	5	11	25	11	4	0
Marlborough	·815	56·4	53·3	54·8	49·4	63·7	38·7	4	69·7	13	53·4	51·6	81	88	9·0	7·1	4·99	·88	30	25	0	0	17	0	1	1	4	1	12	23	4	3	11
Strathfield Turgiss	·821	58·4	54·0	56·2	49·1	64·5	38·8	4	69·2	18	54·9	52·3	79	88	8·7	7·1	5·12	·86	30	24	0	0	16	0	0	0	2	1	13	35	6	2	1
Norwood	·819	58·7	55·0	56·8	50·1	65·3	41·8	4	71·1	14	55·0	52·9	78	86	8·3	5·6	3·63	·63	24	20	0	0	11	0	0	0	3	2	11	22	14	1	7
Croydon	·829	57·8	54·6	56·2	49·8	64·1	42·1	5	68·7	14	53·8	52·1	76	84	8·6	5·7	3·71	·77	24	20	0	0	13	0	0	1	1	5	15	29	7	0	2
Bournemouth	·830	55·8	54·0	54·9	51·8	59·4	43·9	4	67·6	18	53·9	52·5	87	89	7·3	7·5	4·21	·88	30	19	0	0	13	1	0	1	2	6	13	24	9	5	0
Eastbourne	·845	57·8	54·6	56·2	51·1	62·2	41·5	4	68·0	27	55·1	53·2	83	90	7·9	6·6	4·07	1·43	2	17	0	1	14	2	1	1	1	3	4	15	23	11	1
Ramsgate	·864	58·4	54·4	56·4	50·5	66·0	42·8	4	75·2	11	55·3	53·0	81	90	7·6	6·6	2·71	·97	25	15	0	0	9	1	0	1	2	2	4	35	1	0	15
AndleyEnd	·809	58·1	53·7	55·9	49·1	64·2	38·0	5	70·9	14	54·5	52·2	78	90	7·9	6·2	3·86	·62	11	25	0	0	15	0	2	0	1	10	4	32	5	3	3
Hillington	·789	58·3	53·3	55·8	47·8	64·3	35·3	5	70·0	28	55·2	52·2	81	92	8·0	7·7	4·34	·64	30	22	0	0	15	0	0	2	5	13	5	29	3	3	0
Lowestoft	29·799	57·9	54·4	56·1	49·4	61·9	41·0	4	69·9	28	54·3	52·3	78	86	7·3	6·1	2·10	·34	2	20	0	1	10	1	0	2	5	3	6	22	18	4	0
Columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

Phenomena observed at the Stations during June, 1879.

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Scaleby	●▲	●	●	...	...	...	●	●ꓘ	●T	...	●	●	...	...	...	●	●	...	●	●	●▲ꓘ	...	●	●	●T	●	●	●	●	●
Gainford	●	...	...	●	...	...	●	...	●ꓘ	●T	●	●	...	...	...	●☰	...	●	●	●	●▲ꓘ	...	●	●	●	●	●	...	●	●
Wakefield	●	●	●	...	...	●	●	●	●	●ꓘ	●	●ꓘ	...	...	...	●	●	...	●	●	●	...	●	●T	●	●	●	...	●	●
Kelstern	●☰	●	...	...	●○	●	●☰	...	●	T	●○	●T	☰	●	●	●☰	☰	...	●○	●	●	...	●	●▲T	●	●○	●	...	...	●ꓘ
Mansfield	●	●	...	...	●	●	●	●ꓘ	●T	●	●	ꓘ	...	●	●	●	●ꓘ	...	●	●	●	●	●	●	●	●	...	...	●ꓘ	●
Buxton	...	●	●	...	...	●	●☰	●ꓘ	●T	●	●T	...	●	●	●	●☰	●	...	●	●	●	●	●	●▲ꓘ	●T	●	●	●	●	●
Cheadle	●	●	...	...	...	●	●☰	●ꓘ	●ꓘ	●	●T	●T	●	●☰	●	●▲	T	...	●	●	●	●	●	●▲	●▲	●	●	...	●ꓘ	●
Llandudno	...	...	...	...	...	●	●	●ꓘ	●	●	●T	●	●T	...	...	●	●	...	...	●	●	...	●	●	●	●	●	...	...	●
Chester	●	●	●	...	●	●	●	●	●	●	●T	●	...	●	...	●	●	...	...	●	●	●	●	●	●	●	●	●	●	●
Shrewsbury (Leaton)	●	●	●	...	●	●☰	●	●T	●T	●T	●ꓘ	●ꓘ	●T	●	●	●☰	●ꓘ	...	●	●	●	...	●T	●	...	●	●	...	●	●
Churchstoke	☰	●	●☰ꓘ	...	●☰	●☰	●☰	●	☰	●☰	●☰ꓘ	●ꓘ	●⩽	●☰	●	●	●☰T	☰	●	●	●	☰	●	●▲T	●T	●	●☰	☰	●	●☰
Cheltenham	●	●	●	...	●	●	●	●	●	●	●T⩽	●▲T	●ꓘ	●T	●	●	●	...	●	●	●	...	●	●	●	●	●	...	●T	●
Carmarthen	...	●	...	...	●	●	●	●	●	●	●T	●T	...	●☰	●☰	●	●	...	●	●	●	...	●	●	●	●	●	...	●	●
Dartmoor	●☰	●☰	...	●	●T	●☰	●☰	●	●☰	●	●	●	●	●☰	●☰	●	●	●	●	●	●☰	●☰	●	●▲☰	●	●☰	●☰	●☰	●☰	●
Babbacombe	●	●☰	☰	○	●ꓘ○	●☰⩽	●☰	●	●	●⩽○	●ꓘ	●	●	●☰	●☰	●☰	●	○	●	●	●	●	●	●	●	●	●	●	...	●○
Downside	●	●	●	...	●○	●	●	●	●	●	●T	●	...	●	●	●☰	●T	...	●	●	●	...	●	●ꓘ	...	●	●	●	●ꓘ	●○
Marlborough	●	●	●T	...	●	●☰	●	●	●	●	●	●	●	●	●	●☰	●	...	●	●	●	...	●	●▲ꓘ	●	●	...	...	●	●
Strathfield Turgiss	●	●	●	...	●○	●☰	●	●	...	●	●	●	●☰ꓘ	●○	●	●☰	...	...	●	●	●	...	●	●▲ꓘ	●	●	●	...	●	●
Norwood	●	●☰	●	Ѱ	●○	☰	●☰	●	●	...	●	●	ꓘ	●○	●	●☰	○	...	●	●○	●	...	●○	●▲ꓘ	●	●	Ѱ	○	○	●○
Croydon	●	●	●	...	●	...	●T	●	●	...	●	●	ꓘ	●	●	●	...	...	●	●	●	...	●	●T	●	●	...	...	...	●
Bournemouth	●	●	...	...	...	●☰	●	●	...	●☰	●	...	...	●☰	●☰	●	●	...	●	●	●	...	●	●	●	●	...	...	...	●
Eastbourne	...	●	●	...	●	☰	●☰	●	...	...	●	●	●ꓘ	●☰	●☰	●☰T	●	...	●	...	●	...	●	...	●	●	...	...	...	...
Ramsgate	●	●	●	●	●	☰	●☰	●	...	...	●	●	...	☰	●☰	☰	...	...	...	...	●	...	...	●	●ꓘ	●	...	...	...	●
Audley End	●ꓘ	●	●ꓘ	...	●	●	●	●	...	...	●	●ꓘ	...	●	●	●	...	●	●☰	●	●	●	●	●ꓘ	●ꓘ	●	●	●T	●	●
Hillington	●T	●	...	...	●	●ꓘ	●	...	●	...	●	●T	...	●	●	●	...	...	●	●	●	...	●	●	●ꓘ	●T	●	●	●	●T
Lowestoft	●	●	●	●	●	●	●☰	●	...	...	●	●	☰	...	●	●☰	...	●	●	...	●	...	...	●ꓘ	●T	●	...	...	●▲	●

EXPLANATION OF THE SYMBOLS.—● indicates rain; ✱ snow; ▲ hail; ☰ fog; ꓘ thunderstorm; T thunder; ⩽ lightning; C solar halo; Ѱ lunar halo.

LIST OF THE STATIONS, WITH THE NAMES OF THE OBSERVERS, &c.

Station.	County.	Lat.	Long.	Above Sea.	Observer.
Audley End	Essex	52° 1′N.	0°13′ E.	154ft.	J. Bryan.
Babbacombe	Devon	50 29	3 31 W.	293	E. E. Glyde, F.M.S.
Bournemouth (South Bourne)	Hants	50 44	1 48 W.	90	T.A.Compton, B.A., M.D., F.M.S.
Buxton	Derby	53 14	1 54 W.	987	E. J. Sykes, F.R.A.S., F.M.S.
Carmarthen	Carmarthen	51 52	4 18 W.	188	G. J. Hearder, M.D.
Cheadle	Stafford	52 58	1 57 W.	646	J. C. Philips, J.P., F.M.S.
Cheltenham	Gloucester	51 54	2 3 W.	184	R. Tyrer, B.A., F M.S.
Chester	Cheshire	53 12	2 53 W.	63	A. O. Walker, F.L.S., F.M.S.
Churchstoke	Montgomery	52 31	3 5 W.	549	P. Wright, F.C.S., F.M.S.
Croydon (Addiscombe)	Surrey	51 23	0 4 W.	201	E. Mawley, F.M.S.
Dartmoor (Prince Town)	Devon	50 33	3 59 W.	1340 ?	W. H. Tooker.
Downside	Somerset	51 15	2 29 W.	592	Rev. T. L. Almond, O.S.B., F.M.S.
Eastbourne	Sussex	50 46	0 16 E.	24	S. Bretton, F.M.S.
Gainford	Durham	54 33	1 44 W.	249	A. Atkinson.
Hillington	Norfolk	52 48	0 33 E.	88	Rev. H. E. B. Ffolkes, M.A., F.M.S.
Kelstern	Lincoln	53 24	0 7 W.	388	D. G. Briggs, F.M.S.
Llandudno	Carnarvon	53 21	3 50 W.	79	J. Nicol, M.D., F.M.S.
Lowestoft	Suffolk	52 29	1 45 E.	85	S. H. Miller, F.R.A.S., F.M.S.
Mansfield	Notts	53 8	1 12 W.	349	W. Tyrer, F.M.S.
Marlborough	Wilts	51 25	1 43 W.	471	Rev. T. A. Preston, M.A., F.M.S.
Norwood	Surrey	51 26	0 6 W.	184	W. Marriott, F.M.S.
Ramsgate	Kent	51 20	1 25 E.	105	Rev. E. A. D. O'Gara, O.S.B., F.M.S.
Scaleby	Cumberland	54 58	2 52 W.	111	R. A. Allison, F.M.S.
Shrewsbury (Leaton)	Salop	52 45	2 57 W.	266	Rev. E. V. Pigott, M.A., F.M.S.
Strathfield Turgiss	Hants	51 20	1 0 W.	195	Rev. C. H. Griffith, B.D., F.M.S.
Wakefield	Yorkshire	53 41	1 30 W.	96	H. Clarke, L.R.C.P., F.M.S.

NOTES ON THE TABLES.

Column 1 is the mean of the readings of the Barometer at 9 a.m. and 9 p.m. corrected for temperature and reduced to sea-level.

Column 4 is the mean of the readings of the Dry-Bulb Thermometer at 9 a.m. and 9 p.m.

Columns 5 to 10. The Maximum and Minimum Thermometers are read and set at 9 p.m., and the readings entered to the same day.

Columns 13 and 14. The Relative Humidity is calculated by dividing the elastic force of vapour, at the temperature of the dew-point, for the month, by that at the temperature of the air (*i.e.* dry-bulb reading).

Columns 15 and 16. The Amount of Cloud is estimated according to the scale 0—10, 0 representing a cloudless sky, and 10 a completely covered or overcast sky.

Columns 17 to 20. The Rain is measured at 9 a.m., and the amount entered to the previous day. A fall of ·006 in. and above constitutes a day of *rain*.

Column 21. When any Snow falls it is entered as a day of *snow*.

Columns 22 and 23. When the mean of the 9 a.m. and 9 p.m. observations of the amount of Cloud is less than 2·0, this is called a day of *clear sky*, but when the mean is above 8·0 it is called an *overcast* day.

Column 24. When the Force of the Wind is 7 and above (on the scale 0—12) this is counted as a *gale*.

Columns 25 to 33 give the sums of the observations of the Direction of the Wind at 9 a.m. and 9 p.m.

Report on the Meteorology of England for the Quarter ending SEPTEMBER 30TH, 1879, *with Monthly Abstracts of Observations made at the Society's Stations.* By WILLIAM MARRIOTT, Assistant-Secretary.

ATMOSPHERIC PRESSURE was below the average.

In *July* the mean pressure, reduced to sea level, was 29·78 ins. The highest readings were in the south, and the lowest in the north. The maximum occurred generally on the 28th, the highest being 30·231 ins. at 11.35 a.m. at St. Leonards. The minimum took place in the north-west and south on the 1st, and in the east and south-east on the evening of the 20th, the lowest reported being 29·042 ins. at 9 p.m. on the 1st at Scaleby.

In *August* the mean pressure was 29·82 ins. The highest readings were in the south, and the lowest in the north, the difference being considerable. The maximum occurred at all stations on the evening of the 31st, the highest being 30·352 ins. at midnight at Babbacombe. The minimum took place in the south-east on the morning of the 17th, but at the other stations on the 27th or 28th, the lowest being 29·123 ins. at 9 p.m. on the 28th at Gainford.

In *September* the pressure was in excess of that of the preceding three months, the mean being 29·97 ins. The highest readings were in the south-east, and decreased towards the north. The maximum occurred on the evening of the 1st, the highest being 30·547 ins. at Ramsgate. The minimum took place in the west and north on the evening of the 8th, or morning of the 9th, and in the south and south-east on the morning of the 24th, the lowest readings reported being 29·239 ins. at 9 a.m. on the 9th at Wakefield, and 29·244 ins. at 9 a.m. on the 24th at Lowestoft.

AIR TEMPERATURE still continued much below the average.

In *July* the mean temperature was 56°·2, and varied from 58°·0 at Ramsgate, and 57°·9 at Norwood, to 51°·4 at Dartmoor and 53°·2 at Buxton. The weather was dull and wet, the only period of fine weather being from the 24th to the 30th. The maximum temperature occurred generally on the 29th, the highest being 80°·2 at Hillington. The minimum took place at most stations on the 11th, but in the north-east on the 12th. The lowest was 41°·4 on the 12th at Wakefield. The mean daily range was only 11°·9.

In *August* the mean temperature was 57°·9, and varied from 60°·6 at Eastbourne, and 60°·3 at Ramsgate, to 53°·4 at Dartmoor and 54°·4 at Buxton. With the exception of the 8th to the 15th, the weather was cold, dull, and very wet, especially during the latter part. The maximum temperature occurred generally on the 12th, except in the south-east. The highest was 78°·2 at Ramsgate on the 14th. The minimum took place on the 10th, 30th, and 31st, the lowest being 39°·1 at Shrewsbury on the 10th, and 39°·0 at Gainford on the 31st. The mean daily range was 12°·4.

In *September* the mean temperature was 54°·2, and varied from 57°·6 at Eastbourne, and 57°·2 at St. Leonards, to 51°·0 at Buxton and 51°·2 at Dartmoor. The weather was comparatively fine and dry during the first and third weeks, but dull and wet during the remainder of the month. The maximum temperature occurred generally on the 3rd and 6th, the highest being 77°·0 at Audley End on the 6th. The minimum took place in the Home Counties on the 1st, and in the north and north-west on the 30th, the lowest reported being 29°·0 at Buxton on the 30th. Owing to the comparatively fine weather, the mean daily range was greater than in the three previous months, being 14°·1.

The Rainfall was largely in excess of the average.

In *July* both the rainfall and the number of rainy days were large. The monthly falls varied from 8·68 ins. at Dartmoor, and 6·48 ins. at Buxton, to 2·72 ins. at Bournemouth and 2·86 ins. at Strathfield Turgiss. The greatest daily falls occurred in the south-west and west on the 19th, and in the east on the 21st, the heaviest being 1·68 in. at Dartmoor on the 19th. Thunderstorms occurred on several occasions, but chiefly in the north.

In *August* the rainfall was excessive, causing great floods in several parts of the country; the number of rainy days was also considerable. The monthly falls varied from 10·89 ins. at Dartmoor, and 9·23 ins. at Carmarthen, to 3·01 ins. at Kelstern, and 3·02 ins. at Gainford. The heaviest falls occurred in the north-west on the 16th and 17th, and in the south and south-east on the 19th; the greatest amount measured by the Society's observers on one day was 2·32 ins. at Cheltenham on the 16th, but Mr. J. Watson, F.M.S., reports that he registered at Waresley, Kidderminster, the extraordinary amount of 6·20 ins. from 6 p.m. on the 16th to 8 a.m. on the 17th, a period of 14 hours. Thunderstorms were frequent and severe.

In *September* the rainfall and number of rainy days were less than for some months past. The monthly falls varied from 8·09 ins. at Dartmoor, and 5·70 ins. at Carmarthen, to 1·41 in. at Wakefield, and 1·43 in. at Gainford. The greatest daily falls occurred in the south and south-east on the 23rd, the largest being 1·86 in. at Lowestoft.

Wind.—In *July* SW winds prevailed throughout the month, and blew a gale at several places on the 1st, 8th, 9th, and 20th. In *August* the direction was SW; gales occurred on two or three occasions. In *September* NE winds prevailed during the first and third weeks, and SW winds during the remainder of the month.

Notes by the Observers.

Babbacombe, *July*.—Another cold, wet, cloudy and damp month, with frequent fogs. A short period of fair weather from the 22nd to the 25th was almost the only break in a dreary month, enabling the hay harvest, though late, to be secured. Butterflies were very scarce.

August.—The month has been very wet, damp, foggy, cloudy and gloomy; most unfavourable for agriculture. The rainfall, 5·49 ins., was more than double the average for the month. The last 2 days were fine, enabling the remains of the hay crop to be saved, though in bad condition, and the cutting of barley to be commenced. Severe thunderstorms occurred on the afternoon and evening of the 2nd and early morning of the 3rd; several accidents through lightning happened in Torquay.

September.—The first 3 days were fine and warm, with great range of temperature; but afterwards the temperature was generally equable, with cloudy and damp weather. Mock suns were noticed on the 22nd and 25th.

BOURNEMOUTH.—The total duration of sunshine was in *July* 136·1 hours, *August* 153·8 hours, and *September* 132·5 hours.

CHELTENHAM, *July*.—Dull and rainy till towards the end, when the temperature rose, and bright days with sun and absence of rain followed. Some hay carried in fine condition at the end of the month.

August.—A month characterised by heavy rainfalls; that on the 16th followed by the fall on the 17th caused much damage, washing away whole fields of hay. Much hay not carried, and some not even cut, at the end of the month. Wheat cutting commenced near Cheltenham on the 30th.

September.—A damp and dull month, with the exception of a few days at the beginning and in the middle. Peaches just fully ripe on the 26th.

CROYDON, *July*.—Throughout the 8 days ending with the 15th the temperature of the air in the shade never once rose to 64°. Owing to the retarding effect on vegetation of the weather of the past few months, one of my roses (Blairii) only came into bloom on the 3rd, five weeks and two days later than last year, and continued in flower until the very close of the month.

August.—Although unseasonably cold, August was not only comparatively warmer than any of the four previous months, but absolutely the warmest month of the year as yet.

September.—Remarkable, as being the eleventh cold and the fifth wet month in succession. The winds of greatest frequency were from two nearly opposite points of the compass, SSW and NE.

EASTBOURNE, *August*.—Vegetation very backward. On the 31st, wheat, barley, &c., still standing, being of a bad quality and colour.

GAINFORD, *August*.—17th, at 2·30 p.m., a peculiarly vivid and blinding flash of lightning descended apparently amongst some trees, just beyond the boundary wall to the NW of my garden. It was accompanied, rather than succeeded, by a terrific explosion. Next day I learned that the "Old Hall" here had been struck, chimneys damaged, soot and lime freely distributed in kitchen and parlour. No lives lost, but several persons were much affected by it.

HILLINGTON, *July*.—A chill, sunless month, the wettest for 18 years, except 1875. Everything very late. Hay harvest in full career in beginning of August.—20th. Tremendous rain and hail (with thunder and lightning): 0·81 in. fell between 4.35 and 4.46 p.m.—22nd. Much land under water. The rainfall on three days exceeded 1·00 in.

August.—Harvest began only on the 25th, the latest for many years.

September.—Seven fine days were recorded. Harvest completed here on September 26th, nearly, if not quite, the latest on record. Crops fairly good.

LLANDUDNO, *August*.—An unprecedented rainfall occurred between 2 p.m. of the 16th and 7 p.m. of the 17th (a period of 29 hours), amounting to 3·67 ins. The average rainfall in 18 years for the whole month is only 2·40 ins.

SHREWSBURY, *August*.—Rain lasted almost without intermission from 11 a.m. on the 16th till 7 p.m. on the 17th:—Total fall 3·04 ins.

Abstract of Meteorological Observations for the Month of July, 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Total Fall.	Greatest Fall in 24 hours.		Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
					Min.	Max.	Min.	Date.	Max.	Date.								Amnt.	Date.														
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	29·714	56·6	54·3	55·5	51·0	61·7	44·5	11	72·7	29	54·0	52·4	83	87	9·1	8·8	5·29	·73	2	25	0	0	24	3	9	6	8	0	1	22	5	1	10
Gainford	·721	56·6	54·2	55·4	50·5	62·2	44·6	26	73·4	29	53·0	52·1	78	86	8·5	7·4	3·39	·61	21	20	0	0	17	5	3	9	4	5	4	12	13	8	4
Wakefield	·743	57·5	56·0	56·8	51·7	62·9	41·4	12	75·4	28	55·0	54·2	84	88	8·6	7·3	3·17	·46	21	16	0	0	14	1	4	1	8	5	6	10	22	6	0
Kelstern	·751	56·8	53·3	55·0	49·4	63·7	42·9	12	75·9	30	54·2	51·9	83	90	8·3	6·7	3·25	·90	21	18	0	0	16	2	3	1	6	7	4	12	19	10	0
Mansfield	·753	57·0	54·3	55·6	50·8	63·2	45·8	12	76·2	29	54·6	52·8	85	90	8·6	6·4	3·27	·75	19	18	0	0	15	0	5	3	3	4	7	12	21	3	4
Buxton	·778	54·1	52·2	53·2	48·7	60·5	40·9	12	71·3	28	52·2	50·6	87	89	9·2	8·2	6·48	1·28	20	22	0	0	21	0	3	2	8	5	0	10	8	25	1
Cheadle	·759	54·5	53·9	54·2	49·8	61·3	45·0	11	72·2	28	52·9	52·4	89	90	8·7	7·8	3·67	·70	19	19	0	0	20	7	5	1	8	5	10	10	11	12	0
Llandudno	·756	57·0	55·7	56·4	53·1	61·3	50·0	2, 11	74·4	29	54·9	54·3	87	91	8·3	8·0	3·33	·64	1	19	0	0	18	1	5	0	7	1	8	5	28	8	0
Shrewsbury (Leaton)	....	57·9	55·9	56·9	50·9	64·2	46·0	6, 27	74·0	29	..	..	..	..	..	..	3·31	·59	19	21	0	..	..	..	4	3	3	3	1	8	28	9	3
Churchstoke	·793	56·6	54·8	55·7	50·8	62·1	47·5	6, 26	73·5	28	53·9	52·8	83	87	7·5	7·2	3·26	1·18	13	19	0	0	12	0	1	3	4	2	5	13	25	9	0
Cheltenham	·795	59·0	56·5	57·8	51·5	65·1	44·0	11	77·0	29	55·8	54·2	80	85	8·7	8·4	3·61	1·10	13	22	0	0	19	1	2	0	1	3	16	5	16	18	1
Carmarthen	·810	57·7	55·0	56·3	51·8	64·2	46·8	11	75·8	29	54·8	53·7	82	91	8·8	8·3	3·92	·81	19	25	0	0	22	0	2	1	1	1	4	10	16	9	18
Dartmoor	·859	51·7	51·1	51·4	48·1	57·1	45·1	2, 3	71·2	29	51·0	50·6	95	96	9·5	8·9	8·68	1·68	19	26	0	0	24	2	4	2	2	4	3	10	15	19	3
Babbacombe	·859	58·3	54·6	56·4	51·9	63·6	47·6	11	70·6	23	55·7	52·9	84	88	8·4	6·8	3·55	·86	16	20	0	0	16	3	2	2	1	3	6	19	20	8	1
Downside	·818	56·6	54·4	55·5	50·6	62·0	46·3	11	76·4	29	54·3	52·7	85	88	8·4	7·4	5·46	1·09	19	21	0	0	15	3	1	3	1	2	7	20	17	11	0
Marlborough	·825	57·6	55·3	56·5	51·5	65·2	44·0	11	77·5	29	54·8	53·5	83	88	9·2	7·6	4·16	·71	19	21	0	0	22	0	4	0	4	1	3	20	17	0	13
Strathfield Turgiss	·820	59·5	55·8	57·6	50·9	66·3	43·9	11	79·6	29	56·2	54·1	80	89	8·8	7·9	2·86	·53	19	17	0	0	20	0	2	0	1	2	9	34	8	4	2
Norwood	·804	59·0	56·8	57·9	52·1	66·1	47·6	11	78·5	29	55·7	54·8	80	87	9·0	7·2	3·42	·59	19	17	0	0	17	3	1	1	2	1	7	6	27	7	10
Croydon	·818	58·9	56·5	57·7	51·7	65·3	47·2	11	77·4	30	55·3	54·4	78	87	9·2	7·0	3·79	·57	20	18	0	0	16	0	0	1	1	3	7	24	15	4	7
Bournemouth	·845	58·1	56·4	57·3	53·3	62·7	49·1	25	72·3	29	55·6	54·4	84	87	8·1	6·8	2·72	·83	19	20	0	1	14	4	1	1	3	2	3	13	21	18	0
Eastbourne	·840	59·2	..	..	53·7	63·6	49·0	11	76·8	29	56·6	..	84	..	..	..	3·42	·80	19	18	0	..	..	..	..	..	..	..	..	..	..	..	..
St. Leonards	·835	58·6	56·4	57·5	53·2	62·2	45·9	11	75·7	29	55·6	54·6	82	88	8·3	7·1	3·02	·60	19	21	0	1	14	5	3	3	2	4	3	12	27	7	1
Ramsgate	·838	59·4	56·6	58·0	52·6	64·1	47·1	6, 11	79·2	30	56·2	55·3	80	91	8·1	6·8	3·20	·70	21	17	0	1	13	2	0	4	3	1	4	26	10	1	13
Audley End	·778	58·9	55·5	57·2	51·2	64·6	45·2	12, 16	78·1	30	56·5	54·2	85	91	..	..	3·76	·61	21	20	0	..	..	..	1	0	0	4	13	17	13	5	9
Hillington	·759	59·0	54·7	56·9	50·2	65·8	43·1	25	80·2	29	56·4	53·8	84	94	8·3	7·7	5·53	1·20	21	16	0	0	20	0	2	6	0	4	7	22	6	15	0
Lowestoft	29·757	59·0	55·9	57·5	51·7	63·2	46·1	6	73·8	30	56·0	54·1	81	88	8·6	7·0	4·75	1·30	20	20	0	1	17	3	1	0	4	2	5	9	29	12	0
Columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

DATE.																														
Scaleby	●	●	●	●	●	●	●	●	●T	…	…	●	●	●	…	…	…	●	●	●	●	…	●	●	●	●	●	●	●☇	●○	●
Gainford	●	●	…	…	…	●	●	●	●	●	…	●≡	●	●	…	≡	…	…	●T	●	●	●	●	≡	●≡	●	…	…	●☈	●	●
Wakefield	●	●	…	…	…	●	…	●	●☈	●	…	●	●	…	…	●	…	…	●	●	●	…	●	…	…	●	…	…	●☇	…	●
Kelstern	●	●T	…	●	…	●	…	●☈	●☈	●T	…	●	●	●≡	≡	●≡	≡	≡	●T	●T	●	●	●	…	…	●	…	…	…	…	●
Mansfield	●	●	●	…	…	●	●	●	●	…	…	●	●T	●	…	●	…	…	●T	●	●	…	●	…	…	●	…	…	☇	●	●
Buxton	●	●	●	●	…	●	●	●	●	●	…	●	●☈	…	…	●≡	…	…	●	●	●	●	●▲	●	…	●	…	…	●	●☇	●
Cheadle	●	●	●	●	…	●	●	●T	●	…	…	●≡	●☈	●T	…	●	…	…	●≡	●	●	…	●	…	…	●	…	…	…	●	●
Llandudno	●	●	●	●	…	●	●	●	●	…	…	●	●	…	…	…	…	●	●	●	●	…	●	…	●	●≡	…	…	…	●	●T
Shrewsbury (Leaton)	●	●	●	●	●	●	●	●	●	…	…	●	●	●	…	…	…	…	●	●	●	●	●	…	●	●	…	…	…	●	●
Churchstoke	●≡	●≡	●	●	●	●	●	●	●	≡	…	●	●☈	●≡	≡	≡	≡	…	●	●≡	●	≡	●	…	●	…	…	…	…	●	●
Cheltenham	●	●	●	●	●	●	●	●	●	…	●	●	●	●	…	●	T	…	●	●	●	●	●	…	●	●	…	…	…	●	●
Carmarthen	●	●	●	…	●	●	●	●	●	●	●	●	●	…	…	●	●	●	●	●	●	…	●	…	●	●	●	…	●	●	●
Dartmoor	●	●	●	●	●	●≡	●≡	●≡	●	…	●≡	●≡	●≡	●	●	●	…	●≡	●≡	●≡	●	…	●	≡	●	●	●≡	≡	●≡	●≡	●≡
Babbacombe	●	●	●≡	●	…	●○	●	●	●	…	●≡	●≡	●	●	○	●≡	≡	…	●≡	●	…	…	●	…	●	●	…	…	≡○	●≡○	●≡
Downside	●	●	●	●	●T	●	…	●	●	…	●	●	●	●	…	●	…	T	●	●	●	…	●	…	●	●	…	…	…	●	●
Marlborough	●	●	●	●	●	●	…	●	●	T	●	●	●	●	…	●	…	●	●	●	●	…	●	…	●	…	…	…	…	●	●
Strathfield Turgiss	●	●☈	●	●	…	●≡	…	●	●☈	●	…	●	●	●T	≡	≡	●≡	≡	●≡○	●	●	…	…	…	…	…	…	≡	≡	●	●
Norwood	●	●▲☈ʊ	●	●	●	●	●	●	●	…	…	●	●	●	…	≡	…	…	●	●▲☈	●T	…	…	…	…	…	…	…	≡	●	●
Croydon	●	●▲T	●	●	●	●	…	●	●	…	…	●	●	●	…	…	●	…	●	●☈	●	…	●	…	…	…	…	…	…	●≡	●
Bournemouth	●	●	●	●	●	●	●	●	●	…	●	●	●	…	…	●	…	…	●	●	●	●	●	…	…	…	…	≡	≡	●	●
Eastbourne	●	●	●	●	…	●	●	●	●	●	●	…	●	●	…	…	…	●	●	●	●	…	●	…	…	…	…	…	≡	≡	●
St. Leonards	●	●	●	●	●	●	…	●	●▲☈	●	●☇	●≡	●	●	…	…	●	●	●	●	●	●	…	…	…	…	…	●≡	…	…	●≡
Ramsgate	●	●	●	●	●	●	…	…	●	●	…	●	●	●	●	…	…	…	●	●	●	●	…	…	…	…	…	…	…	…	●≡
Audley End	●	●	●	●	●	●	●	●	…	●	●	●	●	…	…	…	…	…	●	●	●	●	●	…	…	●	…	…	…	●	●
Hillington	●	T	…	●	…	●	…	●▲☈	●T	●	…	●	●T	●	…	…	…	…	●	●▲☈	●	●	●	…	…	…	…	…	…	●	●
Lowestoft	●	●	●	●▲	●	●	…	●	●	●	…	●	…	●	●	…	…	…	●	●☈	●	●	●	…	…	●	…	…	…	●	●

EXPLANATION OF THE SYMBOLS.—● indicates rain; ✱ snow; ▲ hail; ≡ fog; ☈ thunderstorm; T thunder; ☇ lightning; ○ solar halo; ʊ lunar halo.

Abstract of Meteorological Observations for the Month of AUGUST 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Total Fall.	Greatest Fall in 24 hours.		Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
					Min.	Max.	Min.	Date.	Max.	Date.								Amnt.	Date.														
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	29·720	58·2	55·5	56·8	50·5	65·1	41·3	10	77·0	12	55·3	53·4	82	86	6·9	5·7	3·38	·55	27	21	0	2	12	4	0	3	11	1	1	23	14	1	8
Gainford	·747	57·5	54·6	56·1	49·9	65·4	39·0	31	74·2	11	54·2	52·4	80	86	7·1	5·7	3·02	·47	9	18	0	1	11	2	1	4	0	3	5	18	6	5	20
Wakefield	·764	58·7	56·9	57·8	52·1	65·5	44·1	9	73·3	12	55·6	54·2	81	83	7·1	5·1	3·19	·59	30	16	0	1	9	1	2	4	6	10	4	12	20	2	2
Kelstern	·797	58·5	54·3	56·4	49·7	65·0	41·7	2	71·5	11	55·8	53·0	83	91	7·2	5·4	3·01	·73	27	17	0	2	9	1	2	3	5	7	9	18	14	2	2
Mansfield	·786	59·5	55·0	57·3	50·9	65·1	43·2	10	73·7	12	56·1	53·6	79	91	7·0	5·2	3·39	·80	2	21	0	2	9	0	1	6	3	5	10	14	14	1	8
Buxton	·804	55·5	53·3	54·4	48·7	61·9	41·1	31	71·9	12	52·7	51·6	82	88	7·5	6·7	8·22	1·15	16	22	0	1	14	0	3	3	4	6	1	9	19	17	0
Cheadle	·813	55·6	54·6	55·1	49·9	63·1	41·9	10	74·1	12	53·8	52·8	88	88	7·7	6·4	7·26	1·64	17	19	0	0	11	5	7	0	7	7	7	11	10	8	5
Llandudno	·766	58·7	57·3	58·0	53·0	63·7	47·3	10	75·2	12	55·[illegible]	54·9	80	85	6·6	5·3	6·84	1·91	16	15	0	5	12	3	11	0	3	2	9	5	30	2	0
Shrewsbury (Leaton)	·797	58·4	55·3	56·8	49·8	65·4	39·1	10	75·9	12	55·9	53·8	84	90	7·0	5·7	6·21	1·88	16	20	0	3	11	..	2	2	3	3	9	7	24	3	9
Churchstoke	·816	56·7	55·1	55·9	49·6	63·8	40·2	10	73·0	12	53·9	52·9	82	85	7·2	7·1	4·88	1·39	16	19	0	0	11	0	2	3	7	7	5	19	13	5	1
Cheltenham	·815	60·2	57·0	58·6	51·9	66·7	41·4	24	77·1	12	57·3	55·2	82	89	7·4	6·4	6·56	2·32	16	19	0	1	13	1	4	2	0	1	18	16	16	2	3
Carmarthen	·809	59·5	56·2	57·9	52·3	66·2	42·9	30	76·7	12	56·3	54·4	81	88	7·7	6·8	9·23	1·32	4	23	0	0	14	2	5	0	7	7	8	13	11	5	6
Dartmoor	·860	54·6	52·3	53·4	50·2	58·5	40·5	31	63·9	15	53·4	52·0	92	98	8·5	9·4	10·89	2·28	19	23	1	0	24	4	3	4	5	3	4	16	19	7	1
Babbacombe	·863	60·1	56·2	58·2	53·9	64·5	45·8	30	71·1	13	57·3	54·7	83	90	7·8	7·3	5·49	1·32	19	23	0	1	18	6	2	4	5	2	5	22	15	5	2
Downside	·840	58·6	55·4	57·0	52·1	64·4	45·0	10	76·6	15	56·2	54·1	85	91	7·0	6·1	9·10	1·75	19	23	0	4	11	2	2	8	2	1	6	32	9	0	2
Marlborough	·855	59·9	56·3	58·1	52·3	66·7	44·1	10	77·5	12	56·7	54·6	81	89	7·6	6·1	6·62	1·46	19	19	0	1	15	0	3	2	10	1	2	18	8	1	17
Strathfield Turgiss	·828	61·3	56·8	59·1	52·4	67·9	44·2	10	77·3	12	58·2	55·4	81	91	5·6	6·0	7·09	1·70	2	17	0	1	7	0	0	2	0	6	6	32	8	8	0
Norwood	·847	61·4	58·0	59·7	53·7	68·0	46·1	10	76·2	13, 15	57·9	56·0	79	87	6·9	6·2	4·81	·95	23	17	0	4	13	1	0	3	5	1	8	17	18	0	10
Croydon	·860	61·3	57·7	59·5	53·4	67·2	45·7	10	75·9	13	57·4	55·4	77	85	7·0	5·7	4·61	·81	19	20	0	3	12	0	1	3	3	2	9	25	9	1	9
Bournemouth	·867	60·1	58·1	59·1	55·5	64·2	49·7	31	72·8	12	57·5	56·2	84	88	6·8	5·7	4·75	1·35	19	19	0	2	9	7	2	2	8	1	7	13	24	3	2
Eastbourne	·881	62·0	59·3	60·6	56·3	66·2	47·9	10	75·5	14	58·8	57·2	81	87	7·3	6·1	4·11	1·05	19	18	0	3	14	5	1	5	3	3	3	7	24	14	2
St. Leonards	·881	61·0	59·0	60·0	56·3	64·6	51·5	30	73·8	12	57·9	56·8	81	86	7·5	6·3	3·27	·63	19	20	0	3	12	7	1	5	3	2	6	22	15	4	4
Ramsgate	·902	61·6	58·9	60·3	55·5	67·0	47·2	10	78·2	14	58·3	57·3	80	90	7·3	5·4	3·19	·58	19	20	0	1	7	2	1	4	3	2	4	30	5	0	13
Audley End	·818	61·0	57·3	59·2	52·4	67·5	42·3	10	76·3	13	57·6	55·6	80	89	4·0	4·9	3·33	·62	2, 19	16	0	14	3	1	0	0	0	3	15	31	6	3	4
Hillington	·814	61·1	56·2	58·6	51·5	68·8	44·2	10	76·8	18	58·3	55·3	83	94	6·9	6·3	3·41	·77	19	14	0	2	10	1	0	3	3	10	6	21	13	6	0
Lowestoft	29·829	60·2	57·5	58·8	53·5	65·9	47·0	10	71·2	1	57·2	55·8	82	89	6·7	5·7	3·94	1·14	2	18	0	3	10	3	2	1	3	11	2	20	16	7	0
Columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

Phenomena observed at the Stations during AUGUST, 1879.

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Scaleby	..	...	●	●	●	●T	...	●	●	...	...	●	●Ꝁ	...	...	●	●	●	●	...	●	●	...	●	●	●	●	●	●	●	...
Gainford ..	...	...	●≡Ꝁ	●≡	●	●	...	...	●	...	...	...	●T	...	...	●≡	●Ꝁ	...	●≡	...	●	●Ꝁ	...	●	●	●	●	●	●	●T	<
Wakefield ..	...	●	●Ꝁ	...	●	●	...	...	...	...	≡	...	●Ꝁ	...	...	●	●T<	...	●	●	●	...	...	...	●Ꝁ	●	●	●	●	●Ꝁ	...
Kelstern	...	●	≡Ꝁ	...	●	●	...	...	●	...	...	...	●Ꝁ	≡	●	●≡	≡T	≡T	●	●	●	...	...	●	●	●	●	●	●	●	...
Mansfield ..	●	●	●Ꝁ	...	●	●	...	●	...	...	...	...	●Ꝁ	●	●	●≡Ꝁ	T	●	●	●	●	●	...	...	...	●	●	●	●	●	●
Buxton	...	●	●≡	●	●	●	●	...	...	...	...	...	●Ꝁ	...	●	●	●<	●Ꝁ	●	●	●	●Ꝁ	...	Ꝁ	●	●	●	●	●▲	●▲T	●▲
Cheadle	...	●T	●	...	●	●	...	...	...	...	...	...	●▲Ꝁ	...	●	●	●Ꝁ	...	●	●	●	●	...	●	●	●	●	●	●	●	...
Llandudno ..	...	●	T	●	●<	...	...	...	...	...	...	Ꝁ	...	...	<	●	●<	...	●T	...	●	●	...	●	●	●	●	●	●	●	...
Shrewsbury	...	●	≡	●	●	...	...	●	...	...	...	●	●≡	...	...	●≡T	●	...	●	●	●	●▲	...	●≡	●	●	●	●	●	●	●
Churchstoke	...	●	●Ꝁ	...	●	●	...	●	...	...	...	≡	●	Ꝁ	...	●≡Ꝁ	●	T	●	●	●	●	...	●	●	●	●	●	●	●	...
Cheltenham	...	●Ꝁ	●Ꝁ	...	●	●	...	...	..	...	...	●	●Ꝁ	...	●T	●Ꝁ	●	...	●	●	●	...	●	●	●	●	●	●	...	●	...
Carmarthen	...	●Ꝁ	●▲Ꝁ	●	●	●	●	T	...	●	...	Ꝁ	●	≡	●	●	●	●	●	●	●	●Ꝁ	...	●	●	●	●	●	●	●	...
Dartmoor ..	○	●Ꝁ	●≡	●≡	●≡	●	●≡	≡	●	≡	≡	●T	●≡	≡<	●	●	●	●≡	●	●≡	●	●	●	●≡	...	●	●≡	●≡	●*	...	...
Babbacombe	≡	●▲Ꝁ○	≡Ꝁ	●	●	●	●≡	...	○	●≡	≡	●≡○	●	●≡	●	●<	●	●	●	●≡	●≡	●	●≡	●≡	●<	●	●	●○	○Ʊ	...	...
Downside ..	...	●Ꝁ	≡Ꝁ	●	●▲Ꝁ	●	●	●	...	●	≡	...	...	...	●	●Ꝁ	●Ꝁ	●	●	●	●	●	●	●	●	●	●	●	●	●	...
Marlborough	...	●Ꝁ	Ꝁ	...	●	...	●	...	...	...	...	...	●	●	●	●	●	...	●	●	●	●	●	●	●	●	●	●	●	...	...
Strathfield T.	...	●▲Ꝁ○	≡	●	...	...	...	...	...	...	...	Ꝁ	●Ꝁ	...	●	●<	●	●	●Ꝁ	●	●	●	●	●	...	●	●	●	●	...	≡
Norwood	...	●<Ʊ	Ꝁ	...	●	●T	●	...	...	≡	≡	...	○	○	●≡○	●	●	...	●	●	●Ꝁ	●	●	●	...	●	●	●○	●	...	...
Croydon	...	●	●Ꝁ	...	●	●Ꝁ	●	●	...	...	...	...	...	..	●≡	●<	●	...	●≡	●	●Ꝁ	●	●	●	●	●	●	●	●	...	...
Bournemouth	...	●Ꝁ	●Ꝁ	...	●	●	●	...	...	●	...	...	●Ꝁ	≡	●	●T	...	●	●	●	●	●	●	●	...	●	●	●≡	...	...	...
Eastbourne	...	...	●	...	●	...	●	●	...	●≡	≡	...	...	T	...	●	●	...	●	●	●Ꝁ	●	●	●	●	●	●	●	...	●	...
St. Leonards	≡	T	●Ꝁ	...	●	●	●	...	...	●	...	...	●	...	●≡	●	●	...	●≡	●T	●Ꝁ	●	●	●	●	●	●	●	...	●	...
Ramsgate ..	●	●<	●	...	●	●	●	●	...	...	...	...	●	...	●	●	●	...	●	●	●Ꝁ	●	●	...	●	●	●	●	..	...	...
Audley End	...	●▲Ꝁ	Ꝁ	...	●	...	...	●		...	...	...	●	...	...	●<	●	●	●	●	●	●Ꝁ	●	●	...	●	●	●	...	...	...
Hillington ..	...	●Ꝁ	≡Ꝁ	≡	●	...	...	...	...	...	...	...	●T	...	●	●<	●T	●T	●	●	●T	...	...	...	●	●▲<	●	●	...	...	...
Lowestoft ..	●	●	▲Ꝁ	...	●	●Ꝁ	...	●	...	...	...	...	●	...	●≡	●	●	●	●	●	●Ꝁ	...	●	●	...	●	●	●	...	...	...

EXPLANATION OF THE SYMBOLS.—● indicates rain; * snow; ▲ hail; ≡ fog; Ꝁ thunderstorm; T thunder; < lightning; ○ solar halo; Ʊ lunar halo.

Abstract of Meteorological Observations for the Month of September, 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Total Fall.	Greatest Fall in 24 hours.		Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
					Min.	Max.	Min.	Date.	Max.	Date.								Amnt.	Date.														
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	29·880	53·6	51·5	52·6	45·3	60·6	33·0	24	68·7	6	51·5	50·3	86	92	5·7	6·0	3·14	·50	25	19	0	2	7	4	2	3	4	4	2	23	13	1	8
Gainford	·893	54·3	51·6	52·9	45·1	61·3	31·8	30	69·0	4	50·5	49·7	76	87	6·2	6·1	1·43	·56	8	11	0	4	9	1	2	3	1	6	2	18	1	5	22
Wakefield	·921	54·8	53·2	54·0	47·2	61·4	30·4	30	69·8	3	51·6	50·9	80	84	6·7	5·5	1·31	·27	8	15	0	4	11	0	1	1	6	5	9	16	15	6	1
Kelstern	·946	54·4	51·2	52·8	46·1	61·2	37·4	27	69·4	7	52·1	50·0	84	92	6·0	5·2	3·47	·69	13	16	0	9	10	0	3	7	7	1	6	21	8	5	2
Mansfield	·935	54·0	51·3	52·6	46·8	61·4	31·9	31	70·3	3	51·6	50·2	84	92	6·3	5·8	2·62	·53	24	13	0	7	13	0	2	6	3	3	6	19	12	2	7
Buxton	·963	52·3	49·8	51·0	44·0	58·1	29·0	30	65·2	3	50·0	48·4	84	90	7·0	6·1	4·25	·77	8	13	0	3	9	0	3	7	1	1	3	14	13	16	2
Cheadle	·928	52·0	51·5	51·7	46·2	59·6	37·7	25	67·6	3	50·1	50·3	87	92	7·2	6·0	2·71	·48	28	13	0	4	13	4	5	3	7	3	5	15	10	6	6
Llandudno	·912	56·1	54·3	55·2	50·4	60·1	42·0	30	67·0	6	53·4	52·1	82	85	6·8	6·3	3·00	·72	26	17	0	3	12	0	10	3	1	4	7	8	24	3	0
Shrewsbury (Leaton)	·956	54·6	51·9	53·3	46·8	61·1	33·0	30	69·0	3	52·3	50·7	85	92	..	..	2·87	·69	7	17	0	..	..	..	1	3	6	5	4	9	17	4	11
Churchstoke	·960	53·3	51·2	52·3	46·6	60·0	31·8	30	68·6	6	50·8	49·6	83	89	7·0	7·1	2·79	·70	7	18	0	3	13	1	0	1	4	4	1	14	23	5	8
Cheltenham	·960	55·5	52·4	53·9	45·8	61·8	35·6	1	66·7	3	53·0	50·9	84	90	7·6	5·7	3·26	·72	7	16	0	4	13	0	7	4	1	0	13	3	12	5	15
Carmarthen	·946	56·2	53·3	54·7	48·6	62·7	31·8	25	69·8	6	53·7	52·0	83	91	7·7	7·1	5·70	1·05	11	19	0	3	17	0	5	1	4	7	0	21	11	0	11
Dartmoor	·985	52·0	49·4	50·7	45·4	56·6	38·0	2	64·9	6	50·2	48·7	88	95	7·1	8·2	8·09	1·21	28	16	0	3	17	1	3	6	7	3	2	13	14	8	4
Babbacombe	·987	57·6	53·2	55·4	49·6	62·1	39·2	2	68·4	3	54·9	51·9	83	91	6·8	6·2	3·43	·88	23	16	0	5	12	1	5	12	1	2	4	17	12	5	2
Downside	·975	54·6	51·9	53·3	47·8	61·2	39·8	1	69·4	15	52·8	51·0	88	94	6·7	6·1	5·36	·87	22	20	0	3	10	0	5	10	3	2	7	23	4	5	1
Marlborough	·989	56·0	52·2	54·1	46·9	63·5	35·2	1	70·7	3	53·4	50·8	83	90	6·9	5·5	3·98	·72	22	18	0	7	14	0	3	3	2	0	5	12	3	3	29
Strathfield Turgiss	·988	57·4	53·1	55·2	47·0	65·3	35·7	1	72·6	3	54·7	51·9	83	92	6·7	6·3	2·48	·60	23	11	0	6	14	0	2	4	0	6	5	21	9	5	8
Norwood	·979	56·6	54·1	55·3	49·3	64·0	39·6	1	71·9	3	54·1	52·4	84	98	7·3	6·1	2·95	1·42	23	13	0	3	15	0	2	3	8	0	7	14	13	3	10
Croydon	·989	56·5	53·7	55·1	49·2	63·6	38·9	1	70·3	3	53·9	51·8	83	87	7·3	5·6	3·17	1·33	23	12	0	4	14	0	1	5	3	2	7	20	6	1	15
Bournemouth	·990	57·1	55·6	56·4	50·6	62·1	39·2	3	65·9	4	55·0	53·7	87	87	6·2	5·6	3·69	·67	23	18	0	4	9	4	10	8	5	2	0	13	14	6	2
Eastbourne	·999	58·6	56·6	57·6	51·7	63·5	43·0	25	68·1	4	55·8	54·5	83	86	6·5	6·1	2·90	1·03	23	12	0	4	11	2	7	8	3	2	1	9	13	14	3
St. Leonards	29·995	58·2	56·1	57·2	52·4	62·5	41·0	25	68·7	19	55·3	54·0	82	86	6·3	5·3	2·85	·86	23	14	0	8	13	3	10	9	2	1	5	12	8	5	8
Ramsgate	30·020	58·7	55·6	57·1	51·7	63·2	42·0	25	69·8	3	56·0	53·9	83	89	6·2	5·2	3·09	1·21	24	13	0	5	9	0	5	11	0	2	5	16	10	4	7
Audley End	29·965	56·8	52·0	54·4	45·6	63·6	36·2	1	77·0	6	54·3	50·7	84	91	5·0	4·9	3·14	·94	23	18	0	10	8	0	3	0	4	5	12	13	10	3	10
Hillington	·953	56·6	51·7	54·2	45·6	64·2	35·2	1, 27	74·1	6	54·8	51·3	88	97	6·7	5·9	3·32	·76	28	16	0	6	12	0	5	6	7	5	4	19	5	8	1
Lowestoft	29·953	57·2	54·9	56·1	49·5	62·5	40·0	1	72·8	3	54·3	52·9	82	87	6·3	4·9	3·39	1·86	23	14	0	6	12	2	1	5	10	2	2	16	12	10	2
Columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

Phenomena observed at the Stations during SEPTEMBER, 1879.

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Scaleby	●	●	●	...	●	...	●	●⛈	●	●	●	●	...	...	...	...	...	...	...	●	●	●	●	...	●	●	●	●	...	●
Gainford	Ψ	...	...	...	●	≡	●≡	●⛈	●	●	...	...	...	...	...	...	≡	≡	●	...	●	●	...	≡	...	●	≡Ψ	●	...	●
Wakefield	●	●	...	...	...	●	●	●	●	...	●	●	●	...	...	...	...	...	...	...	●	●	...	●	...	●	...	●	...	●≡
Kelstern	...	...	...	...	...	●≡	●≡	●T	●	...	●	●	●	...	...	...	●≡	≡	≡	≡	●	●	●	●	●	●⛈	...	●	...	●
Mansfield	...	...	...	...	●	...	●	●	●	...	●	●	●	...	...	...	≡	≡	...	≡	●	●	...	●≡	...	●	...	●	...	●≡Ψ
Buxton	...	...	...	...	●	...	●	●	●	...	●	...	●	...	...	...	...	...	...	●	●	●	...	●	●	●⛈	...	●	...	≡
Cheadle	...	...	...	...	...	≡	●	●⛈	●	...	●	●	●	...	...	...	●	≡	≡	...	●	●	...	●≡	...	●	...	●	...	●
Llandudno	...	...	●	●	●	...	●	●	●	...	●	●	...	...	...	...	...	≡	...	●	●	●	●	●▲⛈	●	●▲⛈	...	●	...	●≡
Shrewsbury (Leaton)	...	...	...	●	●	...	●	●	●	...	●	●	●	...	...	...	...	[illegible]	...	●	●	●	●	●	●	●T	≡	●	...	●≡
Churchstoke	...	...	...	●	...	...	●	●	●	...	●	●	●	...	...	...	●≡	●	...	...	●	●	●	●<	●	●	●	●	...	●≡
Cheltenham	...	...	...	...	...	●	●	●	●	...	●	●	●	...	...	...	...	...	≡	...	●	●	●	●	●	●	...	●	●	●
Carmarthen	...	...	●	●	...	●	●	●	●	...	●	...	●	...	...	...	●	...	...	●	●	●	●	●	●	●	●	●	...	●
Dartmoor	...	...	...	...	≡	...	●	●	●	●	●	●≡	●	...	≡	...	≡	●T	...	●≡	●≡	●	●	...	●	●≡	≡	●	≡	●≡
Babbacombe	...	...	...	...	...	●≡	●	●	●	●	●	●	●≡	...	...	...	●	...	≡	...	●○	●○	●	●○	○Ψ	●	...	●	○	●
Downside	...	...	≡	●≡	●	●	●	●	●	●	●	●	...	...	...	...	●≡	≡	≡	●≡	●	●	●	●	●	●	...	●	●	●≡
Marlborough	...	...	...	...	●	...	●	●	●	●	●	●	●	...	...	...	●≡	≡	≡	≡	●	●	●	●	●	●	≡	●	●	●≡
Strathfield Turgiss ..	≡	...	≡	≡	●≡	≡	≡	●	●	...	●	●	●	...	≡	≡	≡	≡	≡	≡	...	●○	●	●	...	...	≡	●○	...	●≡
Norwood	≡	≡	...	≡	≡	≡○	●	●	●	...	...	●	●≡○	≡	≡	●○	●≡	●≡	≡	≡	○	●	●	●	...	...	≡	●○	≡	●≡
Croydon	...	...	...	≡	...	≡	●	●	●	...	...	●	●	≡	≡	●	●<	≡	≡	≡	...	●	●	●T	...	...	≡	●	...	●
Bournemouth	...	...	...	≡	●	...	●	●	●	●	●	●	●	...	..	●	●	...	...	...	●	●	●	●	...	●	...	●	●	●
Eastbourne	...	...	...	...	...	...	●T	●	●▲	...	...	●	●	●	...	...	...	...	≡	...	●	●	●	●	...	...	...	...	●	●
St. Leonards	...	...	...	...	...	...	●⛈	●	●	...	●	●	●	...	...	●	≡	≡	≡	≡	●	●	●	●	...	...	...	●	●	●
Ramsgate	...	...	...	...	...	...	●	●	●	●	...	...	●	●	...	...	●<	●	...	...	...	...	●	●	●	...	...	...	●	●
Audley End	...	...	...	●	○	●	●	●	●	●	≡	●	●	●	≡	≡	●<	●	...	...	...	●	●	●T	...	●T	≡	●	●	●
Hillington	...	...	...	...	●	...	●≡	●▲	●	...	●	●	●	...	...	...	●<	●T	...	...	●	●	●	●	...	●T	...	●	...	●
Lowestoft	...	...	...	...	○	●	●≡	●	●	...	...	●	●	...	...	...	●⛈	≡T	...	...	●	●	●	●	...	...	...	●	●	●

EXPLANATION OF THE SYMBOLS.—● indicates rain; ✱ snow; ▲ hail; ≡ fog; ⛈ thunderstorm; T thunder; < lightning; ○ solar halo; Ψ lunar halo.

LIST OF THE STATIONS, WITH THE NAMES OF THE OBSERVERS, &c.

Station.	County.	Lat.	Long.	Above Sea.	Observer.
Audley End	Essex	52° 1′N.	0°13′ E.	154ft.	W. Harrison.
Babbacombe	Devon	50 29	3 31 W.	293	E. E. Glyde, F.M.S.
Bournemouth (South Bourne)	Hants	50 44	1 48 W.	90	T.A.Compton,B.A.,M.D., F.M.S.
Buxton	Derby	53 14	1 54 W.	987	E. J. Sykes, F.R.A.S., F.M.S.
Carmarthen	Carmarthen	51 52	4 18 W.	188	G. J. Hearder, M.D.
Cheadle	Stafford	52 58	1 57 W.	646	J. C. Philips, J.P., F.M.S.
Cheltenham	Gloucester	51 54	2 3 W.	184	R. Tyrer, B.A., F M.S.
Churchstoke	Montgomery	52 31	3 5 W.	549	P. Wright, F.C.S., F.M.S.
Croydon (Addiscombe)	Surrey	51 23	0 4 W.	201	E. Mawley, F.M.S.
Dartmoor (Prince Town)	Devon	50 33	3 59 W.	1350	W. H. Tooker.
Downside	Somerset	51 15	2 29 W.	592	Rev. T. L. Almond, O.S.B., F.M.S.
Eastbourne	Sussex	50 46	0 16 E.	24	S. Bretton, F.M.S.
Gainford	Durham	54 33	1 44 W.	249	A. Atkinson.
Hillington	Norfolk	52 48	0 33 E.	88	Rev. H. E. B. Ffolkes, M.A., F.M.S.
Kelstern	Lincoln	53 24	0 7 W.	388	D. G. Briggs, F.M.S.
Llandudno	Carnarvon	53 21	3 50 W.	79	J. Nicol, M.D., F.M.S.
Lowestoft	Suffolk	52 29	1 45 E.	85	S. H. Miller, F.R.A.S., F.M.S.
Mansfield	Notts	53 8	1 12 W.	349	W. Tyrer, F.M.S.
Marlborough	Wilts	51 25	1 43 W.	471	Rev. T. A. Preston, M.A., F.M.S.
Norwood	Surrey	51 26	0 6 W.	184	W. Marriott, F.M.S.
Ramsgate	Kent	51 20	1 25 E.	105	Rev. E. A. D. O'Gara, O.S.B., F.M.S.
St. Leonards-on-Sea	Sussex	51 51	0 33 E.	116	H. Colborne, M.R.C.S., F.M.S.
Scaleby	Cumberland	54 58	2 52 W.	111	R. A. Allison, F.M.S.
Shrewsbury (Leaton)	Salop	52 45	2 57 W.	266	Rev. E. V. Pigott, M.A., F.M.S.
Strathfield Turgiss	Hants	51 20	1 0 W.	195	Rev. C. H. Griffith, B.D., F.M.S.
Wakefield	Yorkshire	53 41	1 30 W.	96	H. Clarke, L.R.C.P., F.M.S.

NOTES ON THE TABLES.

Column 1 is the mean of the readings of the Barometer at 9 a.m. and 9 p.m. corrected for temperature and reduced to sea-level.

Column 4 is the mean of the readings of the Dry-Bulb Thermometer at 9 a.m. and 9 p.m.

Columns 5 to 10. The Maximum and Minimum Thermometers are read and set at 9 p.m., and the readings entered to the same day.

Columns 13 and 14. The Relative Humidity is calculated by dividing the elastic force of vapour, at the temperature of the dew-point, for the month, by that at the temperature of the air (*i.e.* dry-bulb reading).

Columns 15 and 16. The Amount of Cloud is estimated according to the scale 0—10, 0 representing a cloudless sky, and 10 a completely covered or overcast sky.

Columns 17 to 20. The Rain is measured at 9 a.m., and the amount entered to the previous day. A fall of ·006 in. and above constitutes a day of *rain.*

Column 21. When any Snow falls it is entered as a day of *snow.*

Columns 22 and 23. When the mean of the 9 a.m. and 9 p.m. observations of the amount of Cloud is less than 2·0, this is called a day of *clear sky*, but when the mean is above 8·0 it is called an *overcast* day.

Column 24. When the Force of the Wind is 7 and above (on the scale 0—12) this is counted as a *gale.*

Columns 25 to 33 give the sums of the observations of the Direction of the Wind at 9 a.m. and 9 p.m.

eport on the Meteorology of England for the Quarter ending DECEMBER 31st, 1879, *with Monthly Abstracts of Observations made at the Society's Stations.* By William Marriott, Assistant-Secretary.

Atmospheric Pressure was much above the average.

In *October* the mean pressure, reduced to sea level, was 30·13 ins. The ghest readings were in the south and west, and the lowest in the north and st. The maximum occurred in the north on the 8th, and in other districts the morning of the 12th, the highest being 30·594 ins. at 9 p.m. on the h at Buxton, and 30·591 ins. at 9 a.m. on the 12th at Churchstoke. The inimum took place generally on the morning of the 20th, the lowest ported being 29·105 ins. at Scarborough.

In *November* the pressure was in excess of that of the previous month, the ean being 30·23 ins. The highest readings were in the west and central stricts, and the lowest in the east. The maximum pressure occurred at all ations on the 7th, the highest reading being 30·664 ins. at 11.30 a.m. at bbacombe. The minimum pressure was recorded in the northern districts the evening of the 11th, in the south-west and south on the 21st, and in e south-east on the 30th, the lowest reading being 29·493 ins. on the 11th Scaleby.

In *December* the pressure was higher than for any month since February 63, the mean being 30·31 ins. The highest readings were in the south, d the lowest in the north. The maximum pressure occurred in the north d north-west on the evening of the 12th or morning of the 13th, and in e south and south-east on the evening of the 22nd or morning of the 23rd, e highest readings reported on these occasions being 30·797 ins. at 9 a.m. the 13th at Cheltenham, and 30·815 ins. at 9 a.m. on the 23rd at St. eonard's. The minimum pressure took place in the south generally on the ening of the 4th, and in the north on the evening of the 30th or the orning of the 31st, the lowest reading being 29·276 ins. at 9 p.m. on the th at Scaleby.

Air Temperature still continued much below the average.

In *October* the mean temperature was 48°·1, and varied from 51°·4 at astbourne and 51°·2 at Ramsgate, to 45°·3 at Buxton and 45°·7 at Scaleby. he weather was dull, damp and cold throughout the month. The maximum mperature occurred generally between the 4th and 7th, the highest being °·2 at Carmarthen on the 7th. The minimum took place in the west and uth on the 16th, in the north-east on the 22nd, and in the south-east on e 26th. The lowest recorded was 24°·5 at Cheltenham on the 16th. The ean daily range was 12°·0.

In *November* the mean temperature was 38°·6, and varied from 43°·9 at landudno and 41°·7 at Scarborough to 36°·2 at Dartmoor and 36°·5 at uxton. The weather was fine and dry but cold, especially during the latter rt of the month. The maximum temperature occurred in the north on the h, and in the other districts on the 18th, the highest being 60°·6 at

Carmarthen on the 18th. The minimum took place generally in the south and south-east on the 15th and 16th, and in the north and north-west on the 22nd. The lowest readings were 12°·0 at Buxton on the 22nd, and 16°·9 at Strathfield Turgiss on the 16th. The mean daily range was 10°·5.

In *December* the mean temperature was 32°·8; and varied from 38°·9 at Llandudno and 36°·9 at Babbacombe to 29°·5 at Audley End and 30°·2 at Hillington. The weather was cold till the 27th, the frost being intense from the 1st till the 14th. A sudden change took place on the 28th, when the weather became mild. The maximum temperature occurred generally on the 28th, but at a few places on the 29th and 31st. The highest was 56°·0 at Llandudno and Wakefield on the 28th. The minimum temperature took place on various dates, chiefly on the 2nd and 7th. The lowest registered at the Society's stations was —5°·5 at Audley End, —3°·8 at Buxton, and 0°·0 at Wakefield on the 7th, and 3°·0 at Scaleby on the 4th. The mean daily range was 11°·8.

The Rainfall was much below the average.

In *October* the rainfall was greatest in the west, and least in the south-east, the quantities varying from 5·49 ins. at Dartmoor to 0·58 in. at Norwood. The number of rainy days was very uniform throughout the country. The greatest daily falls occurred in the north on the 14th, and in the other districts generally on the 24th; the heaviest fall, however, was 1·50 in. at Dartmoor on the 20th.

In *November* the rainfall and number of rainy days were small in most districts, but large in the north-east. The monthly falls varied from 3·26 ins. at Scarborough, and 2·18 ins. at Lowestoft, to 0·22 in. at Babbacombe, and 0·28 in. at South Bourne. The greatest daily falls occurred mostly on the 20th and 21st, but the heaviest was 0·78 in. at Scarborough on the 29th; snow fell generally from the 20th to the 30th.

In *December* the rainfall was greatest in the west, and least in the east. The monthly falls varied from 4·16 ins. at Dartmoor and 3·94 ins. at Buxton to 0·68 in. at Hillington and 0·64 in. at Lowestoft. The greatest daily falls occurred generally on the 30th and 31st, the largest being 1·82 in. at Buxton and 1·56 in. at Downside on the 31st. Snow fell at nearly all stations on the 1st, 5th, and 30th. A thunderstorm with hail passed over the southern counties on the 30th.

Fog was very prevalent all over the country, especially in October and December.

Wind.—In *October* the general direction of the wind was SW till the 4th, E and NE from the 5th to the 16th, W and SW from the 17th to the 25th, and NE for the remainder of the month. Calms and variable airs were reported from several places. In *November* the prevailing winds were from the N, except in the north, where SW winds blew for several days. Gales and strong winds were experienced on a few occasions, chiefly in the north. In *December* the general direction of the wind was SW, but there were variable airs or calms at many places. Severe gales were felt all over the country from the 27th to the 31st.

NOTES BY THE OBSERVERS.

BABBACOMBE, *October*.—It has been a very dry month. On the 14 days, rom the 3rd to the 16th inclusive, no rain was measured, this being the ongest dry period since one of 25 days ending October 9, 1877. Fine bright weather prevailed in the first week, but afterwards it was generally dull, gloomy and misty.

November.—The month has been extremely dry, the rainfall (0·22 in.) being only $\frac{1}{17}$th of the last 15 years' average for this locality. Fine, bright, cold weather prevailed from the 12th to the 16th, and on the 22nd and 23rd.

December.—It has been a dry and very cold month, 0·18 in. of rain fell in the first 23 days. In the remarkably long dry period of 82 days, from October 3rd to December 23rd inclusive, only 1·09 in. of rain fell, and 21 wet days were reported. Fine bright weather prevailed about the 1st, 12th, 17th and 22nd. Parhelia occurred from 8.45 to 9 a.m. on the 4th.

CHELTENHAM, *November*.—A generally dry month, with high barometric pressure. A heavy fall of snow (rather more than 8 ins.) on the 21st. Temperature low during the latter part of the month, the ice sufficiently firm for skating on the 30th.

December.—A month noted for great atmospheric pressure, and very slight disturbance of the atmosphere; the rainfall low.

CROYDON, *October*.—Between the 2nd and 18th, or for 15 days, no rain fell during the daytime, and on only one night to the depth of ·007 in. This is the longest period of dry weather that we have enjoyed at Addiscombe this year.

November.—Dahlias were killed on the 14th, or 15 days earlier than last year. The last rose-bloom of the year was gathered on the 17th, or 19 days earlier than in 1878.

December.—During 3 days (11th-13th) no observed reading of the barometer was lower than 30·610 ins. The minimum temperature on grass, or rather on snow, of 1°·9, which was registered on the 2nd, is the lowest yet recorded here (1872-9). On 4 other nights this same thermometer indicated over 20° of frost. For 21 consecutive days (7th to 27th) the temperature of the soil at 1 foot continued below 34°, and once fell to 33°·2 (17th). During the greater part of Christmas day, owing to a very dense smoke fog, the garden wall was quite invisible at a distance of 50 yards.

DOWNSIDE, *October*.—Sycamores and chestnuts stripped at the beginning of the last week.

HILLINGTON, *October*.—This month, with a few fine days, was much beneath the average in pleasantness. The rainfall was 1·3 in. less than the mean of 13 years, 1866-78.

November.—The rainfall 1 in. below the mean of 13 years. More snow than usual fell during the latter part of the month.

December.—Ground covered with snow from November 30th to January 14th, greatest depth 3 ins. Frost (with slight intermissions of very superficial thaw) December 1st-28th. An unusual amount of fog, mist and rime. Rainfall 2·19 ins. below the mean of 13 years.

SCARBOROUGH, *October*.—The mean temperature has been exactly the same as the average for the previous 11 years. On the whole the month has been a very agreeable one.

November.—The mean temperature has been 0°·9 below the average of the previous 11 years, and the rainfall 0·06 in. less than the past 13 years' average. It has fallen in small daily quantities except during the last two days, when heavy falls of snow and hail occurred. The mean sea temperature here for the month has been 46°·1, being 4°·7 above that of the air, and 0°·9 higher than the mean day temperatures of the air.

December.—The mean temperature for the month has been 3°·6 colder than the average of the preceding 11 years. The rainfall has been 2·16 ins. less than the previous 13 years' average, and is remarkably small for December. The only December out of the 13 when a less quantity fell here was in 1873. Snow fell at the beginning of the month till it reached a depth of 12 ins., accompanied by intense cold during the nights. A thaw followed in the second week, and the last few days of the month were milder, with strong wind squalls from WSW and SW.

SOUTH BOURNE, *October*.—The smallest October rainfall registered in the Bournemouth district during my observations of 13 years. Sand Martins under South Bourne cliffs up to the end of the month.

November.—Extraordinarily small rainfall, only 0·23 in; mean of 12 years to 1878 inclusive 3·31 ins., next lowest 1·04 in., 1867. October and November rainfall only 1·01 in., against mean of 12 years to 1878 inclusive, 6·59 ins.; next lowest, 3·35 ins. in 1869, highest 11·31 ins. in 1872.

The total duration of sunshine was in October 99·10 hours, November 72·95 hours, December 54·60 hours.

ERRATA.

AUDLEY END—*January to June*—The mean pressure is ·020 in. too low.

BUXTON—*May*—Rainfall, for 3·45 ins. read 3·46 ins.

September ,, ,, 4·25 ins. ,, 4·47 ins.

,, No. of Rainy Days, for 13 days read 14 days.

LOWESTOFT—*February*—Rainfall, for 2·60 ins. read 2·40 ins.

,, No. of Rainy Days, for 20 days read 19 days.

LIST OF THE STATIONS, WITH THE NAMES OF THE OBSERVERS, &c.

Station.	County.	Lat.	Long.	Above Sea.	Observer.
Audley End	Essex	52° 1′N.	0°13′ E.	154ft.	W. Harrison.
Babbacombe	Devon	50 29	3 31 W.	293	E. E. Glyde, F.M.S.
Buxton	Derby	53 14	1 54 W.	987	E. J. Sykes, F.R.A.S., F.M.S.
Carmarthen	Carmarthen	51 52	4 18 W.	188	G. J. Hearder, M.D.
Cheadle	Stafford	52 58	1 57 W.	646	J. C. Philips, J.P., F.M.S.
Cheltenham	Gloucester	51 54	2 3 W.	184	R. Tyrer, B.A., F M.S.
Churchstoke	Montgomery	52 31	3 5 W.	549	P. Wright, F.C.S., F.M.S.
Croydon (Addiscombe)	Surrey	51 23	0 4 W.	201	E. Mawley, F.M.S.
Dartmoor (Prince Town)	Devon	50 33	3 59 W.	1350	W. H. Tooker.
Downside	Somerset	51 15	2 29 W.	592	Rev. T. L. Almond, O.S.B., F.M.S.
Eastbourne	Sussex	50 46	0 16 E.	24	S. Bretton, F.M.S.
Hillington	Norfolk	52 48	0 33 E.	88	Rev. H. E. B. Ffolkes, M.A., F.M.S.
Kelstern	Lincoln	53 24	0 7 W.	388	D. G. Briggs, F.M.S.
Llandudno	Carnarvon	53 21	3 50 W.	79	J. Nicol, M.D., F.M.S.
Lowestoft	Suffolk	52 29	1 45 E.	85	S. H. Miller, F.R.A.S., F.M.S.
Mansfield	Notts	53 8	1 12 W.	349	W. Tyrer, F.M.S.
Marlborough	Wilts	51 25	1 43 W.	471	Rev. T. A. Preston, M.A., F.M.S.
Norwood	Surrey	51 26	0 6 W.	184	W. Marriott, F.M.S.
Ramsgate	Kent	51 20	1 25 E.	105	Rev. T. E. Egan. O.S.B.
St. Leonards-on-Sea	Sussex	51 51	0 33 E.	116	H. Colborne, M.R.C.S., F.M.S.
Scaleby	Cumberland	54 58	2 52 W.	111	R. A. Allison, F.M.S.
Scarborough	Yorks	54 17	0 23 W.	130	F. Shaw, F.M.S.
Shrewsbury (Leaton)	Salop	52 45	2 57 W.	266	Rev. E. V. Pigott, M.A., F.M.S.
South Bourne-on-Sea	Hants	50 44	1 48 W.	90	T. A. Compton, B.A., M.D., F.M.S.
Strathfield Turgiss	Hants	51 20	1 0 W.	195	Rev. C. H. Griffith, B.D., F.M.S.
Wakefield	Yorks	53 41	1 30 W.	96	H. Clarke, L.R.C.P., F.M.S.

NOTES ON THE TABLES.

Column 1 is the mean of the readings of the Barometer at 9 a.m. and 9 p.m. corrected for temperature and reduced to sea-level.

Column 4 is the mean of the readings of the Dry-Bulb Thermometer at 9 a.m. and 9 p.m.

Columns 5 to 10. The Maximum and Minimum Thermometers are read and set at 9 p.m., and the readings entered to the same day.

Columns 13 and 14. The Relative Humidity is calculated by dividing the elastic force of vapour, at the temperature of the dew-point, for the month, by that at the temperature of the air (*i.e.* dry-bulb reading).

Columns 15 and 16. The Amount of Cloud is estimated according to the scale 0—10, 0 representing a cloudless sky, and 10 a completely covered or overcast sky.

Columns 17 to 20. The Rain is measured at 9 a.m., and the amount entered to the previous day. A fall of ·006 in. and above constitutes a day of *rain.*

Column 21. When any Snow falls it is entered as a day of *snow.*

Columns 22 and 23. When the mean of the 9 a.m. and 9 p.m. observations of the amount of Cloud is less than 2·0, this is called a day of *clear sky*, but when the mean is above 8·0 it is called an *overcast* day.

Column 24. When the Force of the Wind is 7 and above (on the scale 0—12) this is counted as a *gale.*

Columns 25 to 33 give the sums of the observations of the Direction of the Wind at 9 a.m. and 9 p.m.

Abstract of Meteorological Observations for the Month of October, 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
					Means of		Absolute Min. and Max.											Greatest Fall in 24 hours.															
		9 a.m.	9 p.m.	Mean.	Min.	Max.	Min.	Date.	Max.	Date.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Total Fall.	Amnt.	Date.	Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	30·081	46·1	45·3	45·7	39·2	53·3	26·0	15	65·3	6	44·7	44·2	89	91	6·8	6·7	1·69	·37	19	18	0	4	15	2	1	9	3	4	1	20	6	3	15
Scarborough	·093	48·9	48·0	48·5	44·0	53·6	38·5	22	61·3	6	46·6	46·0	84	85	7·2	4·1	1·10	·30	14	13	1	2	7	1	8	6	4	2	2	11	18	9	2
Wakefield	·117	47·3	46·4	46·8	41·2	54·5	30·0	26	65·8	5	46·0	45·3	90	91	7·5	6·6	1·02	·21	14	12	0	1	11	0	6	2	4	3	4	11	18	13	1
Kelstern	·123	47·4	44·4	45·9	40·5	53·6	31·9	22	61·7	4	46·5	43·7	93	94	7·0	4·8	1·23	·31	1	13	0	4	9	0	7	11	3	2	3	12	11	11	2
Mansfield	·129	47·1	45·1	46·1	40·5	53·8	28·7	26	62·9	1	46·3	44·4	94	94	7·8	5·8	·98	·19	2, 14	13	0	4	14	1	3	8	3	2	2	11	20	3	10
Buxton	·142	45·6	44·9	45·3	39·5	51·7	29·8	16	61·9	5	44·7	43·9	93	92	8·1	6·3	2·81	·55	3	13	0	1	13	0	6	6	11	5	0	4	4	23	3
Cheadle	·142	46·2	45·8	46·0	41·2	52·7	31·0	16	62·0	5	45·4	44·9	94	93	7·7	7·3	1·27	·33	2	13	0	1	17	6	3	3	12	5	1	12	6	17	3
Llandudno	·131	50·1	49·7	49·9	46·1	54·2	39·8	29	61·3	6	48·2	47·6	86	85	7·1	6·6	1·63	·33	24	11	0	6	18	2	4	2	11	6	5	3	22	9	0
Shrewsbury (Leaton)	·148	47·8	45·5	46·6	41·0	54·2	25·0	16	62·1	1, 4	46·6	44·6	91	93	8·6	6·9	1·52	·61	24	13	0	1	18	..	5	4	5	3	3	2	20	3	17
Churchstoke	·158	47·0	46·6	46·8	41·5	54·3	26·8	16	63·1	23	45·5	45·3	89	90	8·3	6·5	1·16	·23	19	11	0	0	12	0	3	7	4	2	2	9	13	7	15
Cheltenham	·143	49·3	47·0	48·2	41·9	54·5	24·5	16	65·0	4	47·4	45·8	86	91	8·5	7·4	1·12	·29	24	13	0	1	18	0	3	3	7	7	5	6	5	7	19
Carmarthen	·139	50·2	48·7	49·5	44·1	57·8	30·1	16	70·2	7	48·4	47·6	87	92	7·1	6·2	1·84	·32	24	14	0	4	13	0	5	2	21	1	0	6	12	5	10
Dartmoor	·138	46·7	45·0	45·9	41·4	51·1	27·9	16	59·2	4	46·0	44·6	95	97	8·0	8·1	5·49	1·50	20	14	0	1	21	1	0	9	21	4	0	3	14	9	2
Babbacombe	·146	51·7	50·0	50·8	46·2	56·6	32·0	16	64·8	4	49·7	48·4	86	88	7·5	6·9	·80	·20	24	11	0	2	17	2	2	16	15	1	1	8	14	5	0
Downside	·148	47·6	46·7	47·2	42·4	54·8	31·3	16	65·0	6	46·4	45·8	91	93	8·1	6·5	1·91	·84	19	13	0	0	15	3	1	21	5	2	2	17	6	6	2
Marlborough	·159	48·0	46·1	47·0	41·8	55·8	28·2	16	66·9	4	46·4	45·0	88	91	7·8	6·5	1·09	·17	19	14	0	2	16	0	2	10	6	0	0	8	6	3	27
Strathfield Turgiss	·149	49·2	46·9	48·1	41·4	56·2	29·0	26	67·2	4, 6	47·4	45·7	87	91	8·5	6·6	·84	·20	24	10	0	2	20	0	2	16	5	4	1	10	7	12	5
Norwood	·147	49·1	48·0	48·5	43·2	55·5	30·6	26	66·7	4	47·6	46·7	89	90	7·8	5·4	·53	·20	24	10	0	5	14	1	3	6	17	1	1	6	11	5	12
Croydon	·145	48·9	47·7	48·3	42·9	55·3	30·0	26	66·0	4	47·1	46·1	87	88	7·6	6·2	·71	·34	24	12	0	5	17	0	3	12	3	1	3	11	11	2	16
South Bourne	·149	50·7	49·5	50·1	44·9	55·9	30·9	16	63·9	7	48·9	47·8	88	87	6·4	5·8	·78	·23	24	10	0	6	14	1	10	18	7	2	0	5	8	12	0
Eastbourne	·135	52·1	50·6	51·4	45·6	56·4	34·8	16	63·9	7	49·8	49·1	85	89	7·0	6·8	1·42	·55	24	10	0	6	18	3	8	14	9	1	1	4	11	12	2
St. Leonards	·136	51·4	50·0	50·7	46·3	55·3	35·0	16	63·9	6	49·3	48·5	85	89	6·5	5·9	1·00	·31	24	12	0	8	15	2	10	17	7	1	2	5	10	9	1
Ramsgate	·139	51·4	50·9	51·2	45·3	56·5	35·1	17	65·4	7	..	..	..	..	7·1	7·1	1·04	·24	25	12	0	3	14	0	8	4	5	1	0	11	9	2	22
Audley End	·105	50·1	46·9	48·5	..	..	..	..	..	..	..	..	..	..	6·8	6·2	·69	·31	24	13	4	2	9	2	4	4	10	2	5	4	17	4	12
Hillington	·113	49·6	46·3	47·9	41·1	54·7	29·1	22	66·4	6	48·2	45·4	90	93	7·5	6·8	1·21	·26	14	13	0	2	16	0	8	6	5	6	1	12	11	11	2
Lowestoft	30·100	50·6	48·8	49·7	43·5	55·2	33·5	22	64·0	4	48·4	46·9	85	86	6·5	6·3	1·41	·28	15	14	0	4	13	3	6	5	13	1	2	1	18	12	4
Columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

Phenomena observed at the Stations during October, 1879.

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Scaleby	●	●	●	●	…	…	●≡	●≡	≡	≡	●	●	…	●	…	●	…	●	●	●	●	●	●	●	≡	…	…	…	≡	…	●
Scarborough	●	●	●	…	…	…	●≡	≡	≡	≡	…	≡	…	●	●✱▲	…	●	●	●	●	…	…	…	●	…	…	…	≡	●	…	●
Wakefield	●	●	●	…	…	…	≡	≡	…	…	…	…	…	●	…	●	…	●	●	●	●	…	…	●	…	●≡	…	…	●≡	…	…
Kelstern	●	●	●	…	…	…	≡	≡	…	≡	≡	≡	≡	●	●	…	●	●	●	●	…	≡	…	●	…	●≡	…	…	●≡	●	…
Mansfield	●	●	●	…	…	≡	≡	≡	…	≡	≡	≡	≡	●	…	●	…	●	●	●	●	●	…	●	…	●≡	≡	≡	≡	●≡	…
Buxton	●	●	●	…	≡	≡	≡	≡	≡	≡	≡	≡	●	●	…	●	●	●	●	☈	●	●	…	…	●Ψ	●	…	…	≡	≡	…
Cheadle	●	●▲☈	●	…	≡	≡	≡	≡	≡	≡	≡	≡	≡	●≡	…	●	●	●	●	●▲T	●	●≡	…	●≡	…	●	…	…	…	…	…
Llandudno	●	●▲☈	●	…	…	…	≡	≡	≡	≡	…	…	…	…	…	●	…	●	●	●	●	●	●	●	…	≡	≡	…	≡	≡	≡
Shrewsbury (Leaton)	●	●	●	≡	≡	≡	≡	≡	≡	≡	…	●≡	≡	●	…	…	●	●≡	●	●	●	…	…	●	…	●	…	≡	≡	●	…
Churchstoke	●	●	T	…	≡	≡	≡	≡	≡T	≡	≡	●≡	≡	●	…	●	…	●	●	●	●	…	…	●≡	≡Ψ	●≡	≡	≡	≡	≡	≡
Cheltenham	●	●	●	…	…	…	…	≡	…	≡	●≡	≡	●≡	●	…	…	…	●	●	●	●	●≡	●≡	●	…	…	…	…	…	…	…
Carmarthen	●	●▲	●	≡	…	…	…	≡	…	≡	…	≡	≡	●	…	●	●	●	●	●	●	●	●	●	●▲	…	…	…	…	…	…
Dartmoor	●≡	●	●≡	…	…	…	…	…	≡	≡	…	…	…	…	…	…	●	●	●	●▲	●	●≡	●≡	●≡	●	…	●≡	…	…	●	…
Babbacombe	●	●	○	≡	…	…	…	…	…	…	…	…	…	…	…	…	●	●	●	●	●	…	…	●	●Ψ	…	●	○	●	…	…
Downside	●	●☈	…	…	≡	≡	≡	≡	…	≡	≡	●≡	≡	●	…	●	▲	●	●	●▲	●	≡	●≡	●	●	…	…	…	●	…	…
Marlborough	●	●	…	…	≡	…	…	…	…	≡	≡	●≡	●≡	●	…	●	…	●	●	●	●	●	●	●	…	≡	…	…	●	…	…
Strathfield Turgiss	…	●	…	≡	≡	≡	≡	≡	≡	≡	≡	≡	●≡	●	…	…	…	●	●	●	●	●	…	●	≡	≡	≡	≡	●	…	≡
Norwood	●	●	○	≡	…	≡	≡	≡	≡	≡	≡	●≡	●≡	≡	≡	≡	…	●≡	●	∴	…	●≡	●≡	●	…	≡Ψ	…	…	●≡	…	…
Croydon	●	●	…	…	≡	≡	…	≡	…	≡	●≡	●≡	●≡	●≡	…	≡	…	●	●	…	≡	●≡	●	●	≡	≡	…	…	●	…	…
South Bourne	…	●<	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	●	●	●	●	●	●	●	…	●	●	…	…	…	…
Eastbourne	●	●☈	…	…	≡	…	…	…	…	…	…	≡	…	…	…	●	●	●	●	●	…	●	●	●	…	…	≡	…	…	…	…
St. Leonards	●	●☈	…	…	…	…	…	…	…	…	…	≡	●	●	…	●	●	●	●	●	…	●	●	●≡	…	…	…	…	…	…	…
Ramsgate	●	●	●	…	…	…	…	●	●	…	…	…	≡	≡	●▲	●	…	…	…	●	…	…	…	●	●	…	●	●	…	…	…
Audley End	●	●≡T	●≡	≡	≡	…	≡	●≡	≡	≡	≡	≡	≡	●	…	…	…	●✱	●✱	●	✱≡	●	●	●✱	…	≡	…	●≡	…	…	●≡
Hillington	●	●T	●	…	…	…	≡	≡	≡	≡	≡	…	…	●	●	●	●	●	●	…	…	…	…	●	●	●	●Ψ	…	…	…	…
Lowestoft	●	●	…	…	…	…	≡	…	…	…	●	…	…	●	●	●▲	●	●	●	●	…	…	…	●	…	●	…	…	…	●	●

EXPLANATION OF THE SYMBOLS.—● indicates rain; ✱ snow; ▲ hail; ≡ fog; ☈ thunderstorm; T thunder; < lightning; ○ solar halo; Ψ lunar halo.

Abstract of Meteorological Observations for the Month of NOVEMBER, 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
					Means of		Absolute Min. and Max.										Total Fall.	Greatest Fall in 24 hours.															
		9 a.m.	9 p.m.	Mean.	Min.	Max.	Min.	Date.	Max.	Date.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.		Amnt.	Date.	Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	30·229	38·6	37·7	38·1	33·3	44·8	22·5	14, 30	55·5	7	37·5	36·4	91	88	5·8	5·4	1·57	·70	21	10	3	5	8	5	10	7	7	0	2	12	5	5	12
Scarborough	·193	41·7	41·7	41·7	37·7	45·3	27·5	22	54·3	7	39·5	39·4	83	82	7·5	6·0	3·26	·78	29	19	6	1	12	5	16	10	6	0	0	9	9	9	1
Wakefield	·230	40·0	39·3	39·7	34·2	45·7	21·7	15	58·3	9	38·6	37·9	88	89	6·6	6·3	1·33	·33	20	12	3	3	10	0	14	7	3	0	1	7	16	12	0
Kelstern	·215	37·2	36·6	36·9	32·8	43·3	24·5	22	55·5	7	36·3	36·0	92	94	7·7	5·2	2·02	·44	20	17	10	0	10	2	20	9	4	0	1	5	10	11	0
Mansfield	·234	37·5	37·3	37·4	32·9	43·4	18·9	22	56·3	18	36·4	36·2	90	90	6·7	5·6	1·59	·56	20	12	6	5	11	0	14	8	0	0	1	10	10	7	10
Buxton	·243	36·2	36·9	36·5	31·0	42·7	12·0	22	52·4	18	35·5	36·3	93	95	7·5	5·2	1·95	·52	11	13	12	3	12	0	2	10	17	8	1	7	8	7	0
Cheadle	·247	37·4	37·5	37·5	33·4	43·2	22·1	30	52·2	6	36·4	36·5	91	91	7·1	6·2	1·40	·46	20	14	7	6	14	5	17	13	3	0	2	4	5	13	3
Llandudno	·266	44·3	43·5	43·9	40·2	47·3	32·0	14	54·2	19	41·6	41·0	79	78	7·1	7·1	·98	·26	23	11	3	4	16	6	11	7	16	2	2	2	15	5	0
Shrewsbury (Leaton)	·269	38·2	37·9	38·1	32·9	44·2	18·0	22	57·0	18	37·0	36·8	90	90	7·6	6·5	1·22	·40	20	12	2	4	17	..	12	4	5	2	2	1	8	7	19
Churchstoke	·282	38·5	38·2	38·3	33·2	44·5	20·8	22	55·2	18	36·9	36·8	87	88	7·0	7·5	·92	·32	20	11	6	2	19	0	8	10	5	1	0	4	15	11	6
Cheltenham	·250	38·3	37·2	37·7	32·4	43·9	17·0	23	56·0	18	36·9	36·0	88	89	7·6	6·6	1·32	·66	21	13	6	3	15	0	8	5	7	0	5	0	5	5	25
Carmarthen	·265	42·1	40·6	41·3	36·3	48·1	24·7	30	60·6	18	39·9	38·9	82	86	6·7	6·6	·70	·18	11	9	3	3	12	0	21	7	10	1	1	2	6	3	9
Dartmoor	·260	36·7	35·8	36·2	32·1	40·8	21·0	22	50·5	18, 19	35·9	35·3	92	95	8·0	7·2	·48	·15	11	7	3	1	15	0	6	15	14	0	2	2	4	7	10
Babbacombe	·255	41·9	40·8	41·4	37·0	47·6	25·4	14	59·8	18	39·6	38·9	82	85	6·5	5·6	·22	·12	24	6	5	4	10	5	10	16	8	1	1	6	9	8	1
Downside	·260	37·8	38·0	37·9	33·4	44·3	23·5	15	56·8	18	36·6	37·0	90	91	7·3	6·1	·61	·13	10, 11	9	4	5	15	1	6	19	0	1	4	11	2	14	3
Marlborough	·262	36·8	37·3	37·1	33·3	44·8	19·8	15	54·9	18	35·7	36·3	90	91	6·6	6·0	·60	·15	23	11	6	5	13	0	9	8	1	0	0	1	4	7	30
Strathfield Turgiss	·243	37·7	37·1	37·4	32·1	44·5	16·9	16	55·1	5	36·3	36·1	88	91	6·8	6·0	·89	·38	21	10	5	4	13	0	14	19	2	3	0	0	6	13	3
Norwood	·231	37·5	37·9	37·7	33·5	43·2	20·0	15	53·7	18	36·3	36·4	89	87	7·5	5·4	·82	·27	21	11	7	3	13	0	12	8	4	0	1	0	12	13	10
Croydon	·229	36·9	37·3	37·1	33·0	43·3	20·8	15, 23	53·4	18	35·7	35·9	89	87	8·3	5·9	1·20	·38	20	12	8	3	16	0	9	7	1	1	1	4	12	4	21
South Bourne	·248	38·5	39·0	38·8	34·6	45·5	23·2	16	59·8	18	36·7	37·4	85	87	6·1	4·7	·23	·09	20	7	2	7	8	0	22	18	1	0	2	0	6	9	2
Eastbourne	·210	40·0	39·3	39·6	34·3	45·4	22·8	16	54·7	18	37·9	37·5	83	85	7·1	4·9	1·07	·60	21	4	3	5	11	2	15	6	5	3	1	1	4	21	4
St. Leonards	·206	39·9	39·2	39·5	35·7	44·8	26·1	30	54·5	18	37·9	37·5	84	86	7·4	4·9	1·16	·52	21	9	5	5	11	1	20	9	3	2	3	1	8	13	1
Ramsgate	·202	39·8	40·0	39·9	36·0	44·9	25·6	16	52·3	18	38·3	38·3	87	86	8·5	6·9	·83	·22	16	15	6	0	15	0	5	3	7	5	4	3	15	6	12
Audley End	·195	37·4	37·2	37·3	31·5	..	17·2	16	53·7	7	36·4	36·1	91	90	7·1	6·0	·87	·20	22, 24	12	7	5	15	3	22	7	2	3	3	0	7	4	12
Hillington	·193	38·5	37·0	37·8	32·3	43·8	20·1	16, 23	55·6	18	37·2	35·9	89	90	8·2	5·7	1·81	·29	2	20	7	0	13	0	8	15	3	3	1	8	5	17	0
Lowestoft	30·164	40·1	39·4	39·7	35·0	44·6	25·6	16	53·9	7	38·4	37·3	86	83	8·0	6·2	2·13	·39	21	22	10	2	15	2	7	7	6	3	0	2	11	22	2
Columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

Phenomena observed at the Stations during November, 1879.

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Scaleby	...	...	...	≡	...	...	...	...	●	●	●	...	...	...	...	●	●	●	...	●	●*	*	...	●	...	...	...	...	...	●*
Scarborough	●*▲	●*▲	...	...	...	...	...	...	●	●	●≤	...	●▲	▲	...	...	...	●≡	●	●	●*▲	●*	●	●▲	●▲	●▲	●▲	●▲	●*▲	●*▲≤
Wakefield ..	●	...	...	...	ɯ	ɯ	...	...	●	...	●	...	...	...	...	...	●	...	●	●*▲	●*	●	●*	●	●	●	...	...	...	...
Kelstern	●*	●*	●	...	...	...	...	...	●	...	●*≡	...	●	...	...	...	...	●	●	●*▲	●*	≡	●	●	●*	●*	●*	●	*	●*
Mansfield ..	●*	...	...	≡	...	...	...	...	●	...	●	...	...	≡	...	...	...	●	●	●*	●*	*≡	●	...	●*	●*	●	●	...	...
Buxton	●*	...	...	●	●≡	...	...	...	●	...	●*▲	...	...	...	≡	...	●	≡	●	●*	●*	●*	●*	*	*▲	●*	*	●*	*	...
Cheadle	*	...	...	...	...	≡	...	≡	●	●	●	...	≡	...	...	≡	●	●≡	●	●*	●*	●*≡	●	●	●▲	●*	●*	*▲	...	...
Llandudno ..	●	...	...	...	...	...	...	...	●	...	●	●▲	...	...	...	...	●	●≡	≡	●▲	●	●*	●≡	...	...	*≡	...	...	...	●*
Shrewsbury	●	ɯ	...	...	...	...	...	≡	●	●	●▲	●	...	...	...	...	...	≡	●≡	●	●*	●*	●≡	●≡	...	●	...	...	...	...
Churchstoke	●≡	...	...	...	...	...	...	...	●	...	●	●	...	...	...	●	...	≡	●≡	●*	●*	●*≡	≡	≡	≡	●*≡	*≡	≡	●	*
Cheltenham	●*	...	●	≡	...	...	T	..	●	●	●	...	...	...	...	●	●≡	●	...	●*	●*	●*	≡	...	●*	●*	...	...	...	...
Carmarthen	●	...	...	●	...	...	...	...	●	...	●	...	...	...	...	...	...	...	...	●*▲	●*	●	●	...	...	...	...	..	●	*
Dartmoor ..	...	...	...	...	...	...	...	...	...	●≡	●	●	...	...	...	...	●≡	≡	...	...	●*	...	...	●≡	...	*	...	...	...	●*
Babbacombe	●*	...	...	...	...	...	...	...	●	...	●	...	○	...	...	...	...	...	...	●*	*	...	●	●	...	*	...	...	...	*
Downside ..	●	...	...	...	...	...	...	...	●	●	●	...	...	...	...	...	...	●	...	●*	*	...	●	●	...	●*	*	...	...	...
Marlborough	●	...	...	...	...	...	...	≡	●	●	●*	...	...	...	...	...	...	●	...	●*	●*	...	●	●	●*	●*	*	...	...	...
Strathfield T.	...	●	...	...	○	...	...	≡	●	...	●	...	...	...	...	...	●	●	...	●*	●*	*≡	≡	●≡	●*≡	*	●	...	...	...
Norwood	●≡	...	●≡	≡	...	○	≡	≡	...	●≡	●	...	...	≡	≡	≡	≡	●≡	≡	●*≡	●*≡	●*≡ɯ	≡	●≡	●*≡	*	●*≡	*≡	≡	≡
Croydon	●≡	...	●≡	≡	...	...	≡	≡	...	●≡	●	...	...	≡	≡	*≡	...	●≡	●	●*	●*	●*ɯ	...	●≡	●*≡	*	●*	*≡	≡	≡
South Bourne	●	...	...	...	...	...	...	...	●	●	●	...	...	...	...	...	...	...	...	●*	●*	≡	≡	●	...	...	...	...	...	...
Eastbourne	...	...	...	...	...	...	...	≡	...	●	...	...	...	...	≡	≡	...	...	...	●*▲	●*▲	●≡	≡	≡	...	*	...	...	...	...
St. Leonards	●	...	...	...	...	...	...	≡	...	●≡	●	...	...	...	*	...	...	●	●	●*	●*	●	...	≡	●	*	*≡	...	...	...
Ramsgate ..	...	●	...	...	...	...	...	...	...	...	●	...	...	●	●*	●	...	●	...	●*	●*	●*	●	●	●	●▲	*	●*	●	...
Audley End	●≡	●	●	●≡	...	...	...	...	...	...	●	...	...	...	...	...	...	●≡	*	●*	●*	●*	●*	●*≡	...	●*	≡	≡	...	...
Hillington ..	●	●*	●	...	...	...	...	...	●	●	≡	...	●	...	●	...	●	●	●	●*	●*	*	●	●	●	●*	●	●	●*	●*
Lowestoft ..	●	●▲	●	...	...	...	...	...	●	...	●	●	●*▲	●*▲	●*▲	...	...	●*▲	●	●*▲	●*▲	●	●≡	●	●	●*▲	●*▲	●	●*	●*

Abstract of Meteorological Observations for the Month of December, 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
					Means of		Absolute Min. and Max.										Total Fall.	Greatest Fall in 24 hours.															
		9 a.m.	9 p.m.	Mean.	Min.	Max.	Min.	Date.	Max.	Date.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.		Amnt.	Date.	Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	30·197	31·8	32·0	31·9	25·5	38·6	3·0	4	55·0	28	31·1	31·4	94	92	7·1	6·3	1·87	·45	30, 31	12	4	14	4	7	6	6	6	0	1	25	2	1	15
Scarborough	·237	35·0	36·3	35·6	30·9	39·8	19·5	2	54·3	28	33·8	35·0	88	88	6·9	5·5	1·34	·42	4	11	7	4	11	0	3	3	2	3	5	23	18	5	0
Wakefield	·264	31·3	33·6	32·4	25·0	40·3	0·0	7	56·0	28	30·6	33·0	90	93	8·2	7·5	1·56	·37	31	10	4	1	18	1	10	2	1	5	11	10	14	8	1
Kelstern	·291	29·5	31·2	30·3	25·3	36·4	8·2	7	52·9	28, 29	29·0	30·7	91	92	6·3	6·3	1·06	·40	31	11	6	2	11	2	5	5	5	3	7	18	10	6	3
Mansfield	·293	29·8	30·7	30·3	25·0	37·0	3·7	7	52·7	29	..	..	..	..	7·4	5·8	1·15	·24	30	10	5	4	11	0	5	3	1	1	12	18	9	4	9
Buxton	·304	30·1	31·4	30·8	23·1	38·1	— 3·8	7	51·7	28	29·8	30·9	95	93	6·9	7·9	3·94	1·82	31	10	4	0	13	0	1	3	8	4	1	14	25	4	2
Cheadle	·298	31·7	33·1	32·4	28·2	38·1	17·6	5	52·8	28	31·0	32·4	90	93	6·9	5·3	1·34	·62	31	8	5	4	11	5	3	3	7	4	9	8	3	4	21
Llandudno	·249	38·7	39·1	38·9	34·1	44·2	23·0	4, 5	56·0	28	36·8	37·1	84	84	5·8	6·1	1·48	·35	31	11	4	5	10	4	1	2	3	8	4	12	31	1	0
Shrewsbury (Leaton)	·311	32·4	32·8	32·6	26·6	38·8	11·9	2, 4	54·1	28	31·8	32·1	92	92	7·8	5·9	·84	·30	30	6	2	3	14	..	7	2	1	8	5	9	13	2	15
Churchstoke	·320	32·8	34·6	33·7	27·9	40·1	15·2	2	53·3	28	31·7	33·4	87	88	7·5	7·6	1·29	·64	30	12	4	0	14	0	6	10	7	6	2	19	6	6	0
Cheltenham	·318	32·0	32·9	32·5	24·8	38·5	11·2	1	54·5	28	31·2	32·0	90	90	7·5	6·1	·84	·18	30	12	3	1	15	0	2	4	3	7	5	5	1	1	34
Carmarthen	·301	34·7	35·0	34·9	28·9	43·0	17·9	5	53·4	29	33·8	34·2	91	90	5·7	4·3	2·65	·67	27	11	1	9	11	5	3	6	11	3	2	6	6	1	24
Dartmoor	·329	33·1	32·2	32·7	26·6	37·4	18·0	2	49·0	29	32·9	32·1	98	99	7·2	7·1	4·16	1·00	27	6	2	3	14	1	2	10	13	6	0	6	12	3	10
Babbacombe	·323	36·5	37·3	36·9	32·1	42·8	22·8	13	52·3	28	35·3	35·9	89	87	6·6	6·0	1·44	·33	27	13	2	3	12	7	7	8	10	4	5	11	9	5	3
Downside	·327	32·6	33·2	32·9	26·5	38·9	12·6	2	52·3	28	31·9	32·4	92	91	7·8	6·2	3·01	1·56	31	9	3	2	13	2	3	11	1	8	4	17	9	7	2
Marlborough	·338	31·0	32·2	31·6	26·4	38·7	13·4	7	53·3	28	30·5	31·6	92	92	7·9	6·6	1·09	·35	31	10	4	4	18	0	3	3	4	2	0	10	2	1	37
Strathfield Turgiss	·335	31·2	31·6	31·4	24·7	37·3	10·3	7	52·2	29	30·3	30·6	87	86	7·7	6·7	1·21	·44	30	9	5	3	17	0	7	12	4	10	1	12	1	7	8
Norwood	·338	31·5	32·3	31·9	26·5	37·2	13·8	2, 7	52·9	31	30·8	31·4	90	89	7·8	7·8	·77	·27	30	11	6	2	20	3	1	6	8	1	4	10	12	3	17
Croydon	·336	31·2	31·6	31·4	26·0	37·6	13·6	7	53·0	31	30·5	30·8	89	89	7·9	7·5	1·00	·35	30	15	9	2	19	0	1	4	3	1	7	15	4	1	26
South Bourne	·335	33·1	34·4	33·7	28·1	39·9	16·8	7	50·0	29	32·1	33·2	89	88	6·7	4·3	1·13	·42	30	12	1	4	8	4	20	8	6	4	2	5	6	5	6
Eastbourne	·328	34·7	35·2	35·0	29·5	39·9	19·0	17	50·2	31	33·5	34·1	88	90	6·0	6·5	·99	·30	30	8	6	3	13	6	7	8	2	4	3	9	3	9	17
St. Leonards	·335	34·0	34·7	34·4	30·2	38·9	17·6	17	49·3	31	33·0	33·8	89	91	6·4	4·6	·88	·23	28	10	4	4	7	5	7	7	9	6	5	8	3	8	9
Ramsgate	·337	32·5	33·4	33·0	27·9	38·1	20·9	7	50·5	31	32·0	32·8	94	93	7·9	7·4	1·36	·42	7	11	4	0	16	1	2	5	6	2	1	16	8	1	21
Andley End	·312	28·7	30·3	29·5	22·8	..	— 5·5	7	53·2	31	28·1	29·8	89	92	6·4	7·7	·88	..	..	6	4	4	16	2	8	4	3	2	7	6	5	5	22
Hillington	·295	30·4	30·1	30·2	24·0	35·9	5·2	7	52·6	28	29·6	29·5	88	90	8·2	5·9	·63	·12	1	16	6	2	14	1	1	4	5	7	3	28	3	7	0
Lowestoft	30·300	32·3	33·0	32·7	27·3	37·5	13·8	7	52·6	29	31·3	32·2	88	91	6·7	6·5	·64	·18	31	14	3	5	16	3	6	1	5	9	2	9	21	8	1
Columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

Phenomena observed at the Stations during NOVEMBER, 1879.

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Scaleby	...	...	...	≡	...	...	...	...	●	●	●	...	...	...	...	●	●	●	...	●	●✱	✱	...	●	...	...	...	...	...	●✱
Scarborough	●✱▲	●✱▲	...	...	...	...	...	...	●	●	●<	...	●▲	▲	...	...	...	●≡	●	●	●✱▲	●✱	●	●▲	●▲	●▲	●▲	●▲	●✱▲	●✱▲<
Wakefield ..	●	...	...	...	Ψ	Ψ	...	...	●	...	●	...	...	...	...	...	●	...	●	●✱▲	●✱	●	●✱	●	●	●	...	...	...	...
Kelstern	●✱	●✱	●	...	...	...	...	...	●	...	●✱≡	...	●	...	...	...	...	●	●	●✱▲	●✱	≡	●	●	●✱	●✱	●✱	●	✱	●✱
Mansfield ..	●✱	...	...	≡	...	...	...	...	●	...	●	...	...	≡	...	...	...	●	●	●✱	●✱	✱≡	●	...	●✱	●✱	●	●	...	...
Buxton	●✱	...	...	●	●≡	...	...	...	●	...	●✱▲	...	...	...	≡	...	●	≡	●	●✱	●✱	●✱	●✱	✱	✱▲	●✱	✱	●✱	✱	...
Cheadle	✱	...	...	...	...	≡	...	≡	●	●	●	...	≡	...	...	≡	●	●≡	●	●✱	●✱	●✱≡	●	●	●▲	●✱	●✱	✱▲	...	...
Llandudno ..	●	...	...	...	...	...	...	...	●	...	●	●▲	...	...	...	...	●	●≡	≡	●▲	●	●✱	●≡	...	...	✱≡	...	...	...	●✱
Shrewsbury	●	Ψ	...	...	...	...	...	≡	●	●	●▲	●	...	...	...	...	...	≡	●≡	●	●✱	●✱	●≡	●≡	...	●	...	...	...	...
Churchstoke	●≡	...	...	...	...	...	...	...	●	...	●	●	...	...	...	●	...	≡	●≡	●✱	●✱	●✱≡	≡	≡	≡	●✱≡	✱≡	≡	●	✱
Cheltenham	●✱	...	●	≡	...	...	T	..	●	●	●	...	...	...	...	●	●≡	●	...	●✱	●✱	●✱	≡	...	●✱	●✱	...	...	...	...
Carmarthen	●	...	...	●	...	...	...	...	●	...	●	...	...	...	...	...	...	...	...	●✱▲	●✱	●	●	...	...	...	...	..	●	✱
Dartmoor ..	...	...	...	...	...	...	...	...	...	●≡	●	●	...	...	...	...	●≡	≡	...	...	●✱	...	...	●≡	...	✱	...	...	...	●✱
Babbacombe	●✱	...	...	...	...	...	...	...	●	...	●	...	○	...	...	...	...	...	...	●✱	✱	...	●	●	...	✱	...	...	...	✱
Downside ..	●	...	...	...	...	...	...	...	●	●	●	...	...	...	...	...	...	●	...	●✱	✱	...	●	●	...	●✱	✱	...	...	...
Marlborough	●	...	...	...	...	...	...	≡	●	●	●✱	...	...	...	...	...	...	●	...	●✱	●✱	...	●	●	●✱	●✱	✱	...	...	...
Strathfield T.	...	●	...	...	○	...	...	≡	●	...	●	...	...	...	...	...	●	●	...	●✱	●✱	✱≡	≡	●≡	●✱≡	✱	●	...	...	...
Norwood	●≡	...	●≡	≡	...	○	≡	≡	...	●≡	●	...	...	≡	≡	≡	≡	●≡	≡	●✱≡	●✱≡	●✱≡Ψ	≡	●≡	●✱≡	✱	●✱≡	✱≡	≡	≡
Croydon	●≡	...	●≡	≡	...	...	≡	≡	...	●≡	●	...	...	≡	≡	✱≡	...	●≡	●	●✱	●✱	●✱Ψ	...	●≡	●✱≡	✱	●✱	✱≡	≡	≡
South Bourne	●	...	...	...	...	...	...	...	●	●	●	...	...	...	...	...	...	...	...	●✱	●✱	≡	≡	●	...	...	...	...	...	...
Eastbourne	...	...	...	...	...	...	...	≡	...	●	...	...	...	...	≡	≡	...	...	...	●✱▲	●✱▲	●≡	≡	≡	...	✱	...	...	...	...
St. Leonards	●	...	...	...	...	...	...	≡	...	●≡	●	...	...	...	✱	...	...	●	●	●✱	●✱	●	...	≡	●	✱	✱≡	...	...	...
Ramsgate ..	...	●	...	...	...	...	...	...	...	...	●	...	...	●	●✱	●	...	●	...	●✱	●✱	●✱	●	●	●	●▲	✱	●✱	●	...
Audley End	●≡	●	●	●≡	...	...	...	...	...	...	●	...	...	...	...	...	...	●≡	✱	●✱	●✱	●✱	●✱	●✱≡	...	●✱	≡	≡	...	...
Hillington ..	●	●✱	●	...	...	...	...	...	●	●	≡	...	●	...	●	...	●	●	●	●✱	●✱	✱	●	●	●	●✱	●	●	●✱	●✱
Lowestoft ..	●	●▲	●	...	...	...	...	...	●	...	●	●	●✱▲	●✱▲	●✱▲	...	...	●✱▲	●	●✱▲	●✱▲	●	●≡	●	●	●✱▲	●✱▲	●	●✱	●✱

EXPLANATION OF THE SYMBOLS.—● indicates rain; ✱ snow; ▲ hail; ≡ fog; ꓘ thunderstorm; T thunder; < lightning; ○ solar halo; Ψ lunar halo.

Abstract of Meteorological Observations for the YEAR 1879.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humidity		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of Observations of								
					Means of		Absolute Min. and Max.										Total Fall.	Greatest Fall in 24 hours.															
		9 a.m.	9 p.m.	Mean.	Min.	Max.	Min.	Date.	Max.	Date.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.		Amt.	Date.	Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
aleby	29·889	44·4	43·0	43·7	37·7	50·8	3·0	Dec. 4	77·0	Aug. 12	42·6	41·7	86·3	89·2	7·1	6·5	30·72	1·10	Jan. 12	202	36	35	160	37	51	80	115	27	17	189	71	17	163
akefield ...	·924	45·2	44·6	44·9	39·1	51·6	0·0	,, 7	75·4	July 28	43·3	43·0	85·4	87·8	7·7	6·7	25·04	·95	June 7	180	24	16	156	7	81	73	88	61	64	100	173	81	9
elstern	·937	44·2	42·0	43·1	37·8	50·3	8·2	,, 7	75·9	,, 30	42·5	41·0	86·4	91·1	7·4	6·1	30·48	·90	July 21	201	51	32	153	8	73	87	90	61	72	146	98	87	16
ansfield	·936	44·3	42·6	43·5	38·3	50·9	3·7	,, 7	76·2	,, 29	..	..	..	..	7·5	5·9	29·70	·80	Aug. 2	191	52	38	152	1	72	81	55	30	78	140	119	35	120
uxton	·953	42·7	41·3	42·0	36·1	48·8	—3·8	,, 7	71·9	Aug. 12	41·0	40·0	86·5	88·8	8·0	6·9	51·00	1·82	Dec. 31	202	50	13	169	0	34	56	122	86	14	114	122	156	26
headle	·938	43·1	42·8	42·9	38·2	49·7	17·3	Jan. 11	74·1	,, 12	41·7	41·5	88·1	89·6	7·8	6·3	36·83	1·64	Aug. 17	182	48	27	167	61	74	64	111	59	75	103	68	102	74
landudno ..	·918	47·6	46·4	47·0	42·6	51·7	19·1	,, 11	75·2	,, 12	45·1	44·3	82·0	84·6	7·0	6·4	29·36	1·91	,, 16	165	26	43	164	23	77	35	133	55	68	62	234	65	1
hrewsbury ..	....	45·1	43·4	44·3	37·9	51·5	9·4	,, 12	75·9	,, 12	..	..	..	..	..	..	31·32	1·88	,, 16	206	30	..	..	..	64	37	65	67	45	67	182	44	159
hurchstoke	·958	44·3	43·6	44·0	38·3	50·9	12·8	,, 11	73·5	July 28	42·4	42·2	84·8	88·2	7·4	7·3	28·41	1·39	,, 16	204	39	5	146	4	73	69	91	51	63	144	146	63	30
heltenham ..	·945	46·2	44·5	45·4	38·5	52·3	11·2	Dec. 1	77·1	Aug. 12	44·3	43·1	86·1	89·5	8·0	6·8	32·63	2·32	,, 16	212	35	20	183	8	69	44	57	66	123	85	104	80	102
armarthen ..	·936	47·3	45·1	46·2	40·7	53·9	14·1	Jan. 11	76·7	,, 12	45·1	43·8	84·3	90·3	7·3	6·6	49·78	1·53	June 30	210	16	36	178	10	106	31	131	55	39	111	90	41	126
Dartmoor	·953	42·9	41·4	42·2	37·8	47·7	15·0	,, 11, 12	71·2	July 29	41·9	40·9	92·3	95·8	7·8	7·4	86·53	2·89	,, 30	227	39	18	203	30	41	95	118	49	37	93	135	101	61
Babbacombe	·956	48·1	45·9	47·0	42·4	53·4	19·1	,, 12	71·1	Aug. 13	45·8	44·4	83·8	88·1	7·3	6·6	41·02	1·53	,, 30	211	34	28	165	60	63	125	78	32	57	172	120	67	16
Downside . ..	·952	44·9	43·6	44·2	39·4	51·2	12·6	Dec. 2	76·6	,, 15	43·3	42·6	88·4	91·7	7·7	6·6	50·41	1·75	Aug. 19	210	34	24	172	26	35	159	28	47	55	233	82	80	11
Marlborough..	·967	45·2	43·7	44·5	39·2	52·7	13·4	,, 7	77·5	July 29 Aug. 12	43·3	42·4	85·3	89·5	7·9	6·6	39·07	1·46	Jan. 1 Aug. 19	203	34	31	200	0	49	80	51	12	30	136	58	34	280
Strathfield T.	·959	46·9	44·3	45·6	38·8	53·3	10·3	,, 7	79·6	July 29	44·5	42·8	82·5	87·4	7·7	6·9	34·49	1·70	Aug. 2	173	36	30	194	0	58	110	28	72	51	196	83	92	40
Norwood ...	·954	[illegible]	[illegible]	45·7	40·2	52·8	13·8	,, 2, 7	78·5	,, 29	44·2	43·4	83·8	86·8	7·8	6·3	29·51	1·48	May 28	182	47	34	176	15	48	78	96	22	58	107	153	59	109
Croydon	·96	[illegible]	[illegible]	·4	40·0	52·6	13·6	,, 7	77·4	,, 30	43·8	42·9	82·8	86·0	8·0	6·2	31·06	1·55	,, 28	190	58	30	182	0	38	97	43	34	82	186	93	22	135
South Bourne	[illegible]	[illegible]	[illegible]	[illegible]	41·8	51·8	16·0	Jan. 12	72·8	Aug. 12	44·7	44·2	85·3	87·3	6·6	5·7	29·83	1·37	Jan. 1	187	15	45	127	25	102	117	78	45	42	122	120	91	13
Eastbourne ..	[illegible]	[illegible]	[illegible]	[illegible]	42·1	52·9	19·0	Dec. 17	77·8	July 29	45·7	..	84·3	..	..	..	32·43	1·68	,, 1	161	27	..	..	..	..	..	..	..	..	..	..	..	..
Ramsgate	·97	[illegible]	[illegible]	·7	41·8	53·0	20·9	,, 7	79·2	,, 30	..	..	..	..	7·6	6·6	27·85	1·25	May 23	175	29	19	152	13	48	116	44	27	39	193	86	30	147
Audley End ..	·93	[illegible]	[illegible]	·8	..	..	—5·5	,, 7	78·1	,, 30	..	..	..	..	..	..	28·49	·94	Sept. 23	204	60	..	..	..	46	105	23	75	68	166	70	99	78
Billington ..	·93	[illegible]	[illegible]	4·8	38·2	52·4	5·2	,, 7	80·2	,, 29	44·5	42·1	85·4	91·1	7·8	7·0	30·11	1·20	July 21	201	57	18	188	5	39	114	63	110	44	200	55	101	4
Lowestoft	29·929	[illegible]	[illegible]	45·6	40·2	51·2	13·8	,, 7	73·8	,, 30	44·3	42·9	82·8	86·9	7·4	6·3	27·30	1·86	Sept. 23	197	26	33	167	22	40	74	103	68	44	120	173	97	11
	1			4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

●	*●	●	●	●	●	●	●	:	●	●	●	≡●	●	●	●	●	●	●	●	●	●	●	●	●	●
●	*●	*●	*●	*●	*●	▲*●	●	▲*●	▲*●	●	⋉▲●	*●	⋉▲●	▲●	▲*●	⋉▲*●	⋉▲*●	⋉▲*●	⋉●	⋉▲*●	<▲*●	:	●	●	●
▲●	●	●	:	●	*●	●	●	●	●	●	▲●	≡●	●	▲●	●	●	:	●	●	:	≡●	●	:	:	:
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*●	≡*●	*●	●	*	:	:	*	≡	≡	:	:	≡	*●	:	≡	:	Ʊ≡	≡*	:	:	:	:	:	:	*●
*●	≡▲*	*●	*	≡*●	*●	*	:	:	:	*	:	≡	●	*	:	*	*●	≡▲*●	:	*	*●	:	*	*●	*●

Allenheads	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Silloth -	-	-	21·9	19·8	17·8	21·6	24·5	20·4	[illegible]	[illegible]	[illegible]	[illegible]	25·0	22·0	25·0
Sunderland -	-	-	31·0	20·0	20·0	29·0	21·0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	29·9	23·3	23·9
Carlisle	-	-	15·5	15·9	19·5	25·5	15·5	11·5	[illegible]	[illegible]	[illegible]	[illegible]	26·6	22·0	25·0
Bywell	-	-	28·0	24·0	25·0	22·0	23·0	25·0	[illegible]	[illegible]	[illegible]	[illegible]	25·7	23·0	21·5
North Shields	-	-	29·2	27·2	27·0	25·0	30·3	20·0	25·2	22·0	26·2	21·6			

N OF THE SYMBOLS.—● indicates rain; * snow; ▲ hail; ≡ fog; ⋉ thunderstorm; T thunder; < lightning; C solar halo; Ʊ lunar halo.

From this table it will be seen that on the 10th of January the lowest reading was 12°· Salisbury, on the 11th was 11°·7 at Liverpool, on the 12th was 10°·0 at Holkham, on the

18°·0 at Sheffield, on the 21st was 18°·5 at Carlisle, and on the 22nd was 11°·8 at Carlisle, on the 23rd was 12°·0 at Allenheads, on the 24th was 14°·3 at Bolton, on the 1st of February was 23°·3 both at Allenheads and Bolton, on the 24th was 15°·2 at Allenheads, on March 23rd was 28° at Bolton, on the 24th was 25°·5 at Bolton, on the 25th was 20°·6 at Caterham, and on the 26th was 25° at Bolton. The continuance of these low readings to the end of the quarter indicates the persistence of the cold weather.

During the whole of the quarter the weather has been characterised by almost continued severity, as was also the case during the two last months of the year 1878; this long cold period set in on October 27th, 1878. The mean temperature of the 159 days ending March 31st was 36°·9, being 3°·4 below the average of 60 years; this long period of cold weather, extending over five months, is more remarkable for its persistence than for its severity at any particular time; it is also noteworthy on account of the almost continual cloudiness of the sky, which was such that the sun's place was seldom visible.

The readings of the barometer in the neighbourhood of London were alternately above and below their averages from the 1st to the 15th of January, the greatest departure in defect of the average in this period was 0·50 in. on the 3rd, and the greatest departure in excess was 0·32 in. on the 6th, the mean amount in defect for the 15 days was 0·04 in. From the 16th of January to the 1st of February the mean daily readings were all in excess of their averages, the mean amount of daily excess for the 17 days ending February 1st was 0·22 in. From February 2nd to the 28th the mean daily barometer readings were in defect of their averages (except on two days, viz., 4th and 26th, which were respectively 0·05 in. and 0·08 in. in excess of the average); on several days during this period the mean daily values were between 0·6 in. and 0·9 in. in defect, and on the 10th and 17th the mean readings were no less than 1·05 in. and 1·01 in. respectively in defect, the mean amount of daily defect for the 27 days ending 28th February was 0·47 in. The mean readings of the barometer were above their averages from the 1st to the 14th of March (with the exception of three days, viz., 3rd, 5th, and 12th, on which days the readings were a little below their average values); the mean amount in excess of the average for the 14 days was 0·16 in., and from the 15th of March (with the exception of the 17th) to the end of the quarter the mean readings were below their averages, the mean amount in defect for the 17 days ending 31st March was 0·20 in.

The mean reading of the barometer for the month of January was 29·851 ins., being 0·097 in. above the average, and 0·13 in. below that in 1878. The mean reading for February was 29·363 ins., being no less than 0·438 in. below the average, and in the preceding 38 years there is *no* instance of so low a reading for the month of February, the nearest approach was in the year 1843 when the mean reading was 29·473 ins.

The mean reading for March was 29·809 ins., being 0·069 above the average; and 0·08 in. below the value in 1878.

The mean reading of the barometer for the quarter was 29·674 ins., being 0·091 in. below the average of the preceding 38 years.

The atmospheric pressure in January was greater than in December by 0·305 in., in February was less than in January by 0·488 in., and in March was greater than in Februaryby 0·446 in. (From the preceding 38 years' observations the *mean pressure* in January is less than in December by 0·039 in., in February is greater than in January by 0·047 in. and in March is less than in February by 0·061 in. The mean *increase* of pressure from December to January South of latitude 51° was 0·229 in., between 51° and 53° it was 0·312 in., and North of 53° was 0·357 in. The mean decrease from January to February South of latitude 51° was 0·437 in., between 51° and 52° was 0·478 in., between 53° and 54° was 0·504 in., and North of latitude 54° was 0·535 in. The mean increase of pressure from February to March was nearly the same everywhere, and the general mean was 0·441 in.

At Greenwich the *mean temperature* of January was lower than in December by 1°·8; that of February was higher than that of January by 6°·3, and that of March was higher than that of February by 3°·0. (From the preceding 38 years' observations the *mean temperature* of January is lower than that of December by 1°·5, that of February is higher than that of January by 0°·7, and that of March is higher than that of February by 2°·2.) The decrease of mean temperature from December to January from all places was 0°·6; the increase from January to February South of latitude 51° was 4°·8, between 51° and 53° was 6°·2, and North of 53° was 4°·8. The increase from February to March South of latitude 53° was 1°·9, and North of latitude 53° was 3°·0.

The mean temperature of the air for January was 31°·9, being 4°·7 and 6°·8 respectively below the averages of the preceding 108 years and 38 years. It was 8°·5 lower than the value in 1878, and we have to travel back to 1838 before we experience a January so cold as that in the present year. The following are the only instances back to 1771 when the mean temperature of January was as low as 31°·9.

			°				°
In the year	1771	it was	29·9	In the year	1814	it was	26·9
„	1774	„	31·5	„	1815	„	31·9
„	1776	„	27·0	„	1820	„	31·7
„	1780	„	28·6	„	1823	„	31·8
„	1784	„	29·2	„	1829	„	31·7
„	1795	„	23·9	„	1830	„	30·7
				„	1838	„	28·9

The mean temperature of the air for February was 38°·2, being 0°·5 and 1°·2 below the *averages of the preceding* 108 years and 38 years respectively. It was lower than any value *'oe 1875.*

The mean temperature of the air for March was 41°·2, being 0°·1 above the average of the preceding 108 years and 0°·4 below the average of the preceding 38 years. It was 0°·8 lower than the value in 1878.

The mean temperature of the air for the quarter was 37°·1, being 1°·7 and 2°·8 below the averages of the preceding 108 years and 38 years respectively.

The mean high day temperatures of the air were 8°·5, 2°·9, and 0°·9 respectively below their averages in January, February, and March.

The mean low night temperatures of the air were 5°·9 and 0°·5 below their respective averages in January and March; in February the mean was the same as the average. Therefore the days and nights were cold throughout the quarter.

The mean daily ranges of temperature were 2°·6, 2°·9, and 0°·4 respectively below their averages in January, February, and March.

The fall of rain at Greenwich in January was 2·6 ins., being 0·7 in. above the average; in February the fall was 3·8 ins., being 2·3 ins. above the average, and back to 1815 there is but one instance of so large a fall in the month of February; viz., in 1866, when it was 3·9 ins. In March the fall was 0·6 in., being 1·0 in. below the average. The total fall in the quarter was 7·0 ins., being 2·0 ins. above the average, and back to 1815 there are but six instances of so large a fall of rain in the three months ending March 31st; viz., in 1818, when it was 7·7 ins., in 1819 it was 7·1 ins., in 1844 it was 7·6 ins., in 1851 it was 8·0 ins., in 1866 it was 9·0 ins., and in 1876 it was 8·3 ins.

1879. MONTHS.	Temperature of										Elastic Force of Vapour.		Weight of Vapour in a Cubic Foot of Air.	
	Air.			Evaporation.		Dew Point.		Air—Daily Range.		Water of the Thames.				
	Mean.	Diff. from average of 108 years.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.		Mean.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.
	°	°	°	°	°	°	°	°	°	°	in.	in.	grs.	gr.
Jan. -	31·9	−4·7	−6·8	30·4	−6·8	27·0	−8·2	7·1	−2·6	34·9	0·146	−0·056	1·7	−0·7
Feb. -	38·2	−0·5	−1·2	36·7	−1·0	34·7	−0·4	8·3	−2·9	38·9	0·201	−0·006	2·3	−0·1
March -	41·2	+0·1	−0·4	38·5	−0·7	35·2	−1·1	14·2	−0·4	43·0	0·205	−0·010	2·4	−0·1
Means -	37·1	−1·7	−2·8	35·2	−2·8	32·3	−3·2	9·9	−2·0	38·9	0·184	−0·024	2·1	−0·3

1879. MONTHS.	Degree of Humidity.		Reading of Barometer.		Weight of a Cubic Foot of Air.		Rain.		Daily Horizontal movement of the Air.	Reading of Thermometer on Grass.				
										Number of Nights it was			Lowest Reading at Night.	Highest Reading at Night.
	Mean.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.	Amount.	Diff. from average of 64 years.		At or below 30°.	Between 30° and 40°.	Above 40°.		
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
Jan. -	80	−7	29·851	+0·097	563	+10	2·6	+0·7	283	24	7	0	18·7	33·0
Feb. -	87	+2	29·363	−0·438	547	− 6	3·8	+2·8	306	11	14	3	23·0	44·9
March -	80	−2	29·809	+0·069	552	+ 2	0·6	−1·0	316	13	17	1	24·9	42·2
Means -	82	−3	29·674	−0·091	554	+ 2	Sum 7·0	Sum +2·0	Mean 301	Sum 48	Sum 38	Sum 4	Lowest 18·7	Highest 44·9

NOTE.—In reading this table it will be borne in mind that the plus sign (+) signifies *above* the average, and that the minus sign (−) signifies *below* the average.

The average duration of the different directions of the wind referred to eight points of the compass, and the duration of each direction in each month in the quarter were as follows:—

Direction of Wind.	JANUARY.			FEBRUARY.			MARCH.		
	Average.	1879.	Departure from Average.	Average.	1879.	Departure from Average.	Average.	1879.	Departure from Average.
	d.	d.	d.	d.	d.	d.	d.	d.	d.
N.W.	1½	1	− ½	2	2	0	2¾	2	− ¾
N.	3	2	−1	3	3	0	3¼	2	−1¼
N.E.	3¼	8	+4¾	3⅔	4	+ ⅓	4	6	+2
E.	¾	7	+6¼	2	3	+1	2½	4	+1½
S.E.	2¼	5	+2¾	1¼	5	+3¾	2	2	0
S.	4¼	2	−2¼	3	1	−2	2⅓	2	− ⅓
S.W.	9¾	2	−7¾	8	5	−3	7¾	7	− ¾
W.	3½	4	+ ½	2¾	4	+1¼	3¼	5	+1¾
Calm (nearly.)	2¾	0	−2¾	2⅓	1	−1⅓	2⅓	1	−1⅓

The plus sign (+) denotes excesses over averages; the largest numbers affected with this sign in the month of January are opposite to the N.E., E., and S.E., in February to the S.E., and in March to the N.E., E., and W.

The minus sign (−) denotes defects below averages; the largest numbers affected with this sign in the months of January and February are opposite to the S. and S.W., and in March to the N., but there was still a deficiency of S. and S.W. winds in March.

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1879.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.			Mean Degree of Humidity. Satⁿ.=100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer.		Wind.					Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
								Mean						In a cubic foot of Air.							Relative Proportion of							
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.			Maximum in Rays of Sun.	Minimum on Grass.	Estimated Strength.	N.	E.	S.	W.			Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
SOMERLEYTON RECTORY (Suffolk), Rev. C. J. Steward, F.M.S.	50	Jan.	29·977	0·996	46·0	12·2	33·8	35·6	28·4	7·2	32·1	29·8	·166	2·0	0·1	91	565	—	—	1·0	10	14	1	6	5·9	7·8	12	1·30
		Feb.	29·473	1·358	55·9	26·2	29·7	41·7	32·9	8·8	37·1	35·7	·209	2·4	0·2	95	550	—	—	1·0	5	8	9	6	6·9	8·9	22	2·62
		Mar.	29·922	1·038	60·5	27·3	33·2	48·4	33·6	14·8	40·2	36·8	·218	2·5	0·4	88	555	—	—	1·1	7	8	7	9	7·0	5·7	16	1·04
NORWICH (Norfolk), John Quinton, Esq., Jun.	42	Jan.	29·999	1·108	50·0	19·0	31·0	35·4	28·8	6·6	32·2	30·6	·172	2·0	0·1	93	566	—	—	—	6	15	6	4	—	—	5	0·84
		Feb.	29·483	1·326	55·0	27·5	27·5	41·1	34·3	6·8	37·5	36·4	·215	2·6	0·1	96	549	—	—	—	6	8	9	5	—	—	16	2·01
		Mar.	29·920	0·992	59·2	29·0	30·2	47·0	35·5	11·5	40·3	38·7	·235	2·8	0·2	94	555	—	—	—	4	9	8	10	—	—	11	0·53
WROTTESLEY, WOLVERHAMPTON (Stafford), E. Simpson, Esq.	500	Jan.	29·470	0·950	51·5	14·3	37·2	34·7	24·1	10·6	29·6	24·5	·132	1·6	0·4	82	559	—	—	—	7	15	6	3	—	8·5	8	1·90
		Feb.	28·967	1·152	52·6	19·8	32·8	40·4	30·5	9·9	35·5	33·8	·194	2·2	0·3	93	542	—	—	—	6	4	12	6	—	9·2	19	2·40
		Mar.	29·403	0·976	55·5	22·5	33·0	47·4	32·3	15·1	38·8	35·5	·209	2·4	0·3	89	547	—	—	—	6	9	8	8	—	8·1	11	0·58
LEICESTER (Town Museum), W. J. Harrison, Esq., F.G.S.	238	Jan.	29·776	0·998	50·6	17·0	33·6	34·9	26·6	8·3	30·8	26·7	·144	1·6	0·3	83	564	50·4	20·7	0·5	9	14	3	5	—	7·9	12	1·24
		Feb.	29·251	1·328	54·8	23·6	31·2	41·5	34·1	7·4	37·5	34·7	·201	2·3	0·3	90	545	63·3	28·0	0·8	5	7	8	8	—	9·1	21	1·84
		Mar.	29·694	1·026	61·0	26·6	34·4	47·3	34·5	12·8	40·2	35·6	·209	2·4	0·5	84	551	83·7	26·9	1·1	8	7	8	8	—	7·2	14	0·77
NOTTINGHAM (Notts), M. O. Tarbotton, Esq., C.E., F.G.S., F.M.S.	183	Jan.	29·828	0·986	54·7	12·1	42·6	35·6	25·6	10·0	30·7	28·1	·154	1·9	0·2	89	564	52·0	24·6	0·2	7	16	2	6	1·2	7·3	14	1·40
		Feb.	29·307	1·146	53·9	20·3	33·6	41·6	31·9	9·7	36·6	35·1	·204	2·4	0·1	94	547	59·7	30·8	0·3	5	9	8	6	0·7	9·2	21	2·49
		Mar.	29·760	1·038	60·4	26·0	34·4	48·4	32·9	15·5	39·6	37·3	·223	2·6	0·2	92	552	77·7	31·4	0·4	8	9	6	8	2·6	7·0	23	1·19
HOLKHAM (Norfolk), John Davidson, Esq., Assistant to the Earl of Leicester.	39	Oct.	29·663	1·323	67·6	21·7	45·9	57·4	40·7	16·7	49·5	45·0	·300	3·5	0·6	85	539	88·4	38·6	1·7	3	3	20	5	—	6·2	15	2·55
		Nov.	29·640	1·446	50·2	33·4	26·8	45·4	31·4	14·0	38·9	35·9	·212	2·5	0·3	90	551	55·9	28·8	1·9	14	3	6	7	—	8·0	19	7·32
		Dec.	29·623	1·294	51·8	5·7	46·1	37·1	21·9	15·2	31·3	29·3	·161	1·9	0·2	91	560	39·4	20·8	1·1	6	2	11	8	—	7·4	15	1·92
		Jan.	29·964	1·042	52·4	10·0	42·4	36·2	27·5	8·7	32·1	28·8	·158	1·9	0·2	87	565	45·8	22·3	1·8	6	13	7	5	—	8·4	3	1·50
		Feb.	29·456	1·198	54·4	17·7	36·7	40·8	31·5	9·3	36·5	33·9	·195	2·3	0·3	90	550	60·3	26·4	1·4	5	5	16	2	—	8·4	12	2·00
		Mar.	29·898	0·994	54·8	26·0	28·8	46·6	32·7	13·9	39·3	34·9	·202	2·4	0·4	85	555	89·0	27·1	2·1	6	8	12	5	—	6·6	8	0·75
LLANDUDNO (Carnarvonshire), James Nicol, Esq., M.D., and Thomas Dalton, Esq., M.D.	100	Jan.	29·912	0·980	50·0	19·1	30·9	37·7	30·2	7·5	33·9	29·2	·161	1·8	0·5	83	563	—	—	1·0	3	14	7	5	—	6·0	9	0·82
		Feb.	29·887	1·380	50·8	28·2	22·6	43·3	31·7	11·6	38·0	32·3	·190	2·2	0·5	83	547	—	—	1·0	4	8	8	11	—	7·5	16	3·19
		Mar.	29·825	1·168	54·8	28·0	26·8	46·3	37·4	8·9	41·8	35·5	·208	2·4	0·4	79	551	—	—	1·4	4	10	5	12	—	6·5	12	1·46
KELSTERN GRANGE, near Louth (Lincolnshire), D. Grant Briggs, Esq., F.M.S.	393	Jan.	29·621	1·008	47·5	18·9	28·6	34·1	27·2	6·9	30·5	25·9	·140	1·6	0·4	81	560	54·0	24·5	1·0	8	14	5	4	6·8	7·2	15	1·29
		Feb.	29·099	1·392	52·4	18·1	34·3	38·4	30·1	8·3	34·2	32·3	·183	2·2	0·2	92	546	68·0	27·5	1·1	7	7	8	6	7·0	8·1	23	3·07
		Mar.	29·533	1·042	58·8	25·6	33·2	44·9	32·9	12·0	38·0	34·4	·199	2·3	0·4	87	550	84·5	30·8	1·4	7	9	7	8	8·2	7·1	17	1·09
LIVERPOOL OBSERVATORY, John Hartnup, Esq., F.R.A.S.	197	Jan.	29·808	0·978	52·1	11·7	40·4	36·0	28·0	8·0	31·8	27·5	·150	1·7	0·4	83	563	—	—	1·0	4	17	4	6	—	6·7	9	1·60
		Feb.	29·273	1·388	51·8	27·0	24·8	40·8	33·9	6·9	36·9	34·7	·201	2·4	0·2	91	546	—	—	1·0	6	7	6	9	—	8·3	18	2·64
		Mar.	29·724	1·054	54·9	29·6	25·3	45·6	35·8	9·8	40·0	35·9	·211	2·4	0·5	85	551	—	—	1·4	4	9	7	11	—	6·5	13	1·08
SHARPLES (Bolton, Lancashire), Rev. T. Mackereth, F.M.S., F.R.A.S.	481	Jan.	29·515	1·004	50·1	11·4	38·7	36·9	21·9	15·0	29·9	27·7	·151	1·8	0·3	91	559	47·0	19·0	0·4	6	15	6	4	2·5	6·7	7	2·34
		Feb.	28·989	1·310	49·7	22·0	27·7	40·1	29·0	11·1	35·1	32·0	·181	2·1	0·3	87	543	49·6	25·1	0·3	7	8	6	7	3·4	8·2	23	4·41
		Mar.	29·422	1·144	54·4	21·1	33·3	46·3	30·5	15·8	38·3	34·6	·200	2·3	0·4	87	548	64·8	26·5	0·3	6	8	8	9	6·5	8·0	20	2·69
BERMERSIDE OBSERVATORY, HALIFAX (Yorkshire), E. J. Crossley, Esq., F.R.A.S.	530	Jan.	29·499	0·956	—	18·0	—	32·6	25·0	7·6	28·5	25·7	·139	1·6	0·2	89	561	46·8	22·6	0·3	7	15	2	7	—	7·5	4	1·23
		Feb.	28·930	1·330	53·4	27·0	26·4	38·6	31·3	7·3	34·6	33·5	·193	2·2	0·2	96	543	56·7	29·8	0·5	6	11	6	5	—	8·7	18	3·78
		Mar.	29·390	0·980	57·0	28·0	29·0	44·8	33·1	11·7	38·0	33·7	·193	2·2	0·5	85	547	75·5	30·3	0·8	6	7	8	10	—	6·5	14	2·37
HULL (Yorkshire), Mr. E. Peake.	12	Jan.	30·036	1·004	43·0	16·0	27·0	35·8	28·8	7·0	33·0	30·0	·167	2·0	0·2	89	565	40·9	26·2	—	—	—	—	—	1·6	—	18	1·75
		Feb.	29·501	1·226	54·0	25·0	29·0	40·2	32·1	8·1	36·5	32·8	·187	2·1	0·4	87	551	49·8	30·0	—	—	—	—	—	1·5	—	25	3·72
		Mar.	29·938	1·072	56·0	23·0	33·0	45·9	33·5	12·4	39·3	35·4	·207	2·4	0·4	86	556	64·0	31·8	—	—	—	—	—	1·2	—	15	1·29
STONYHURST (Lancashire), Rev. S. J. Perry, F.R.S., F.M.S.,	363	Jan.	29·633	0·994	46·0	17·3	28·7	35·9	25·0	10·9	30·2	24·2	·130	1·5	0·5	77	561	59·4	21·9	1·4	8	15	3	5	—	6·9	8	1·83
		Feb.	29·095	1·304	50·3	24·8	25·5	40·7	32·4	[illegible]	36·0	[illegible]	·188	2·1	0·4	[illegible]	544	68·1	[illegible]	0·9	7	9	6	6	—	9·5	21	2·70

Meteorological Table, Quarter ending March 31st, 1879.

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1879.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.					Mean Reading of Thermometer.		Wind.							Rain.	
								Mean						In a cubic foot of Air.							Relative Proportion of							
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.	Mean Degree of Humidity. Satn. = 100.	Mean Weight of a cubic foot of Air.	Maximum in Rays of Sun.	Minimum on Grass.	Estimated Strength.	N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
BRADFORD (Yorkshire), J. McLandsborough, Esq., C.E., F.G.S.	366	Jan.	29·641	0·988	51·0	22·0	29·0	35·4	27·0	8·4	31·6	27·5	·150	1·8	0·3	83	560	42·4	–	0·9	15	7	4	5	–	7·3	7	1·36
		Feb.	29·120	1·320	47·8	25·0	22·8	39·5	33·0	6·5	36·3	33·9	·195	2·3	0·3	91	544	47·8	–	0·8	10	8	4	6	–	8·6	20	2·46
		Mar.	29·546	1·037	55·0	26·8	28·2	45·3	34·0	11·3	38·6	34·6	·201	2·3	0·4	87	550	59·7	–	1·4	7	9	4	11	–	7·3	16	1·24
COCKERMOUTH (Cumberland), H. Dodgson, Esq., M.D., F.R.A.S., F.M.S.	146	Jan.	29·874	1·016	47·6	14·6	33·0	36·3	25·4	10·9	30·3	26·0	·140	1·6	0·4	82	565	42·0	19·9	0·3	8	14	6	3	0·7	4·8	6	1·48
		Feb.	29·325	1·388	48·0	21·6	26·4	41·3	31·9	9·4	36·4	33·0	·189	2·2	0·4	88	548	58·5	28·2	0·3	8	8	6	6	1·0	7·6	16	2·09
		Mar.	29·758	1·092	54·1	21·6	32·5	45·5	33·9	11·6	39·3	35·2	·206	2·4	0·5	86	553	75·5	29·3	0·9	2	11	5	13	3·2	6·3	18	3·43
ALLENHEADS (Northumberland), Mr. Joseph Charlton, Assistant to W. B. Beaumont, Esq., M.P.	1360	Jan.	28·522	0·933	–	8·8	–	–	21·9	–	–	–	–	–	–	–	–	56·1	–	1·0	–	–	–	–	–	7·5	17	1·28
		Feb.	28·032	1·265	–	13·9	–	–	26·1	–	–	–	–	–	–	–	–	59·2	–	0·9	–	–	–	–	–	8·3	21	5·09
		Mar.	28·408	0·999	–	14·5	–	–	28·7	–	–	–	–	–	–	–	–	73·5	–	1·3	–	–	–	–	–	7·6	23	3·34
SILLOTH RECTORY (Cumberland), Rev. Francis Redford, M.A., F.R.A.S., F.M.S.	28	Jan.	30·015	1·060	49·3	14·5	34·8	36·6	24·4	12·2	30·3	24·3	·131	1·5	0·5	77	568	59·2	21·0	1·0	5	10	11	5	7·0	3·5	7	1·53
		Feb.	29·467	1·415	49·7	24·5	25·2	41·6	30·7	10·9	35·9	31·9	·181	2·1	0·4	86	551	64·2	27·3	1·2	4	12	7	5	9·3	6·3	15	2·39
		Mar.	29·890	1·162	55·3	21·7	33·6	47·3	33·2	14·1	40·0	33·8	·194	2·3	0·6	78	555	75·4	29·7	2·3	2	11	10	8	5·9	5·7	19	2·32
CARLISLE (Cumberland), Isaac Cartmell, Esq., F.M.S.	114	Jan.	29·944	1·068	47·1	11·8	35·3	35·5	22·4	13·1	29·6	25·4	·137	1·7	0·3	84	568	50·8	16·8	1·0	8	10	8	5	3·2	6·9	4	1·18
		Feb.	29·394	1·358	47·8	18·0	29·8	40·5	29·1	11·4	34·8	32·3	·182	2·0	0·3	89	551	56·8	24·8	1·0	7	8	8	5	4·1	7·3	13	1·20
		Mar.	29·804	1·434	56·8	17·9	38·9	47·1	33·1	14·0	39·3	35·9	·211	2·4	0·4	88	554	73·8	29·1	2·1	6	8	5	12	5·3	6·6	13	1·36
BYWELL (Northumberland), Mr. John Dawson, Assistant to W. B. Beaumont, Esq., M.P.	87	Jan.	29·913	0·906	48·0	14·0	34·0	36·5	27·1	9·4	31·4	28·7	·157	1·8	0·3	86	565	41·9	21·3	1·2	5	12	6	8	–	7·7	18	1·58
		Feb.	29·370	1·370	50·0	19·0	31·0	40·9	32·1	8·8	35·9	32·6	·187	2·1	0·4	88	549	46·3	27·0	1·3	4	10	8	6	–	7·8	25	3·28
		Mar.	29·806	1·042	58·0	16·0	42·0	46·4	34·6	11·8	39·1	34·3	·198	2·3	0·5	83	554	56·6	29·8	1·5	4	10	6	11	–	6·2	20	1·99
NORTH SHIELDS (Northumberland), Robert Spence, Esq.	124	Jan.	29·982	1·038	42·2	14·5	27·7	35·7	28·2	7·5	31·8	27·8	·152	1·7	0·4	83	566	–	27·7	1·4	7	7	8	9	–	7·4	14	1·29
		Feb.	29·441	1·399	45·6	24·8	20·8	38·7	32·2	6·5	35·1	32·3	·183	2·1	0·3	89	552	–	31·7	1·4	8	7	7	6	–	8·3	25	3·05
		Mar.	29·870	1·156	55·0	20·0	35·0	44·5	34·0	10·5	38·4	35·1	·204	2·4	0·4	88	556	–	33·6	2·0	7	7	5	12	–	6·7	15	0·80

Second Rain-gauges are placed—

	January.		February.		March.		Total in Quarter.
At Strathfield Turgiss, at the height of 38 feet *above the ground*, the amount collected was	2·28 inches.	-	2·31 inches.	-	0·34 inches.	-	4·93 inches.
,, Oxford, ,, 22 feet ,, ,,	2·41 ,,	-	3·52 ,,	-	0·78 ,,	-	6·71 ,,
,, Nottingham, ,, 39 feet ,, ,,	1·43 ,,	-	2·39 ,,	-	1·17 ,,	-	4·99 ,,
,, Cardington, ,, 36 feet ,, ,,	1·86 ,,	-	2·60 ,,	-	0·70 ,,	-	5·16

NOTE.—*Barometer Reading*, EASTBOURNE, 21st January, 10h. a.m., 29·114 inches, has been altered to 30·114 inches.
,, HELSTON, 10th March, 9h. a.m., 29·486 ,, ,, 30·486 ,,

Thunderstorms occurred on one day in January, 2 days in February, and one day in March.

Thunder was heard but lightning was not seen on 5 days in March.

Lightning was seen but thunder was not heard on 5 days in February, and 3 days in March.

Solar halos were seen on 7 days in January, 2 days in February, and 5 days in March.

Lunar halos were seen on 5 nights in January, 5 nights in February, and 9 nights in March.

Snow fell on 26 days in January, 23 days in February, and 16 days in March; or on 65 days during the quarter. The falls of snow were pretty general all over the country.

Hail fell on 18 days in January, 14 days in February, and 11 days in March.

Fog prevailed on 18 days in January, 20 days in February, and 14 days in March; or on 54 different days during the quarter.

NAMES OF STATIONS.	Mean Pressure of dry Air reduced to the level of the Sea.	Highest Reading of the Thermometer.	Lowest Reading of the Thermometer.	Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	WIND.					Mean Amount of Ozone.	Mean Amount of Cloud.
																		Mean Estimated Strength.	Relative Proportion of N.	E.	S.	W.		
	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°							
Guernsey	29·600	54·0	24·5	29·5	45·4	37·4	24·5	8·0	41·1	37·6	·226	2·6	0·4	87	548	–	–	1·7	8	9	7	7	3·8	7·
Helston	29·668	60·0	23·0	37·0	48·8	35·9	30·0	12·9	41·7	37·2	·222	2·6	0·5	84	550	55·0	32·4	1·6	9	9	7	5	5·1	5·
Truro	29·604	61·0	16·0	45·0	47·6	36·1	34·3	11·5	41·2	38·7	·236	2·7	0·3	91	551	–	–	2·4	8	8	6	8	–	7·
Plymouth	29·675	58·5	17·5	41·0	46·2	34·9	30·8	11·3	40·4	37·3	·223	2·6	0·3	89	553	–	33·6	1·8	8	9	6	7	–	7·
Torquay	29·614	56·6	19·1	37·5	45·1	35·3	29·9	9·8	39·9	35·9	·212	2·4	0·4	85	547	83·1	30·0	1·6	7	9	7	7	3·4	7·
Eastbourne	–	59·0	23·0	36·0	43·7	33·5	27·7	10·2	38·4	35·6	·210	2·4	0·3	90	554	69·1	25·8	0·2	7	10	4	8	0·9	–
Ventnor	29·642	57·6	22·2	35·4	43·5	35·6	25·7	7·9	39·0	36·1	·214	2·5	0·3	90	553	–	–	–	6	11	6	7	7·3	7·
Osborne	29·632	62·2	19·1	43·1	44·0	32·9	30·1	11·1	38·0	36·9	·221	2·6	0·2	96	552	68·9	27·7	0·2	7	8	8	7	–	7·
Bournemouth	29·616	56·5	15·8	40·7	42·6	34·1	27·4	8·5	38·1	34·4	·201	2·3	0·4	87	558	–	–	1·6	7	11	4	7	–	6·
Brighton	29·656	55·6	20·8	34·8	42·1	33·6	25·7	8·5	37·7	34·0	·196	2·3	0·4	86	552	–	31·2	0·9	9	9	5	6	–	7·
Salisbury	–	65·0	11·0	54·0	–	29·9	–	–	–	–	–	–	–	–	–	68·9	28·9	1·4	9	8	7	6	–	7·
Barnstaple	29·601	62·0	18·0	44·0	46·6	35·6	34·0	11·0	40·7	37·8	·229	2·7	0·3	89	552	–	–	1·2	5	9	9	7	–	5·
Bath	29·632	59·8	16·7	43·1	41·6	31·6	31·3	10·0	36·1	33·7	·196	2·3	0·2	91	545	–	29·0	1·7	7	8	7	8	–	7·
Caterham	29·665	60·2	16·8	43·4	40·3	29·9	34·5	10·4	35·5	32·2	·184	2·2	0·4	89	546	–	25·3	1·9	7	8	8	7	–	–
Ramsgate	29·677	61·2	21·6	39·6	42·6	33·6	28·7	9·0	37·8	34·4	·201	2·3	0·4	88	555	62·8	30·7	1·4	9	8	5	7	–	7·
Strathfield Turgiss	29·666	63·6	15·5	48·1	43·0	31·3	36·2	11·7	37·1	32·8	·188	2·2	0·4	85	553	68·7	25·3	0·8	7	8	7	8	1·7	7·
Weybridge Heath	29·703	65·3	15·0	50·3	42·8	31·3	35·9	11·5	36·9	33·3	·191	2·2	0·4	87	555	60·1	27·6	0·9	9	9	8	4	3·5	7·
Marlborough	29·659	62·5	14·7	47·8	42·3	31·1	33·8	11·2	36·0	32·9	·189	2·2	0·3	88	548	68·7	26·7	0·4	7	9	4	9	–	7·
Blackheath	29·655	64·9	20·0	44·9	42·1	31·7	32·6	10·4	36·9	33·3	·191	2·3	0·3	87	554	67·5	28·9	0·8	6	10	7	7	–	7·
Camden Square	29·652	63·1	19·2	43·9	42·7	32·6	31·4	10·1	37·5	34·0	·197	2·3	0·4	87	554	59·6	30·6	–	9	7	6	8	–	7·
Streatley	29·647	62·6	17·2	45·4	43·3	32·3	33·7	11·0	37·7	34·7	·204	2·4	0·3	90	553	–	–	1·3	7	9	7	7	–	7·
Oxford	29·665	61·5	16·6	44·9	41·7	31·7	31·1	10·0	36·7	33·9	·196	2·3	0·3	91	553	71·1	29·1	1·0	6	9	6	9	1·2	8·
Royston	29·691	64·8	16·6	48·2	42·1	30·1	36·9	12·0	35·8	32·7	·187	2·2	0·3	88	553	–	–	–	8	8	7	8	–	7·
Cardington	29·643	61·0	16·0	45·0	42·1	30·5	33·7	11·6	36·1	33·7	·195	2·3	0·3	91	556	52·2	27·4	1·2	7	9	6	7	–	7·
Cambridge	29·634	65·2	15·2	50·0	42·6	31·8	34·8	10·8	36·9	34·0	·196	2·3	0·3	89	556	72·0	26·8	1·3	6	9	8	7	–	7·
Stockton	29·616	58·2	12·0	46·2	42·9	28·8	34·4	14·1	36·1	34·1	·198	2·4	0·2	93	552	47·3	–	0·4	9	10	6	6	6·4	7·
Lowestoft	29·652	61·7	15·7	46·0	40·8	31·9	31·9	8·9	36·6	31·8	·181	2·1	0·3	83	555	61·7	29·9	0·8	5	10	6	9	8·4	7·
Somerleyton	29·649	60·5	12·2	48·3	41·9	31·6	32·2	10·3	36·5	34·1	·198	2·5	0·2	91	557	–	–	1·0	7	10	6	7	6·6	7·
Norwich	29·638	59·2	19·0	40·2	41·2	32·9	29·6	8·3	36·7	35·2	·207	2·5	0·1	94	557	–	–	–	5	11	8	6	–	–
Wolverhampton	29·654	55·5	14·3	41·2	40·8	29·0	34·3	11·8	34·6	31·3	·178	2·1	0·3	88	549	–	–	–	6	9	9	6	–	8·
Leicester	29·659	61·0	17·0	44·0	41·2	31·7	33·1	9·5	36·2	32·3	·185	2·1	0·4	86	553	65·8	25·2	0·8	7	9	6	7	–	8·
Nottingham	29·639	60·4	12·1	48·3	41·9	30·1	36·9	11·8	35·6	33·5	·194	2·3	0·2	92	554	63·1	28·9	0·3	7	11	5	7	1·5	7·
Holkham	29·628	54·8	10·0	44·8	41·2	30·6	36·0	10·6	36·0	32·5	·185	2·2	0·3	87	557	65·0	25·3	1·8	6	9	12	4	–	7·
Kelstern Grange	29·672	58·8	18·1	40·7	39·1	30·1	32·0	9·0	34·2	30·9	·174	2·0	0·4	87	552	68·8	27·6	1·2	7	10	7	6	7·3	7·
Liverpool	29·632	54·9	11·7	43·2	40·8	32·6	30·2	8·2	36·2	32·7	·187	2·2	0·4	86	553	–	–	1·1	5	11	6	9	–	7·
Bolton	29·665	54·4	11·4	43·0	41·1	27·1	33·2	14·0	34·4	31·2	·177	2·1	0·3	88	550	53·8	23·5	0·3	6	10	7	7	4·1	7·
Bermerside	29·685	57·0	18·0	39·0	38·7	29·8	–	8·9	33·7	31·0	·175	2·0	0·3	90	554	59·7	27·6	0·5	6	11	5	7	–	7·
Hull	29·652	56·0	16·0	40·0	40·6	31·5	29·7	9·1	36·3	32·7	·187	2·2	0·3	87	557	51·6	29·3	–	–	–	–	–	1·4	–
Stonyhurst	29·649	54·8	17·3	37·5	41·0	30·4	28·2	10·6	35·1	30·6	·173	2·0	0·5	83	551	70·6	27·2	1·4	7	10	6	7	–	6·
Leeds	29·663	58·0	23·0	35·0	42·2	31·7	27·3	10·5	36·9	31·4	·178	2·1	0·5	81	555	47·0	–	1·7	7	10	4	9	–	4·
Bradford	29·654	55·0	22·0	33·0	40·1	31·3	26·7	8·8	35·5	32·0	·182	2·1	0·3	87	551	50·0	–	1·0	11	8	4	7	–	7·
Cockermouth	29·637	54·1	14·6	39·5	41·0	30·4	30·6	10·6	35·3	31·4	·178	2·1	0·4	85	555	58·7	25·8	0·5	6	11	6	7	1·6	6·
Allenheads	–	–	8·8	–	–	25·6	–	–	–	–	–	–	–	–	–	62·9	–	1·1	–	–	–	–	–	7·
Silloth	29·653	55·3	14·5	40·8	41·8	29·4	31·2	12·4	35·4	30·0	·169	2·0	0·5	80	558	66·3	26·0	1·5	4	11	9	6	8·4	5·
Carlisle	29·663	56·8	11·8	45·0	41·0	28·2	34·7	12·8	34·6	31·2	·177	2·0	0·3	87	558	60·5	23·6	1·4	7	9	7	7	4·2	6·
Bywell	29·611	58·0	14·0	44·0	41·3	31·3	35·7	10·0	35·5	31·9	·181	2·1	0·4	86	556	48·3	26·0	1·3	4	11	7	8	–	7·
North Shields	–	55·0	14·5	40·5	39·6	31·5	27·8	8·1	35·1	31·7	·180	2·1	0·4	87	558	–	31·0	1·6	7	7	7	9	–	7·

The highest temperatures of the air were at Weybridge, 65°·3; Cambridge, 65°· Salisbury, 65°·0; Blackheath, 64°·9; and 64°·8.

The lowest temperatures of the air were at Allenheads, 8°·8; Holkham, 10°·0; Salisbury, 11°·0; Bolton, 11°·4; and Liverpool

The greatest daily ranges of the temperatures of the air were at Stockton, 14°·1; Bolton, 14°·0; Helston, 12°·9; and 12°·8.

The least daily ranges of the temperatures of the air were at Ventnor, 7°·9; Guernsey, 8°·0; and North Shields, 8°·1.

The greatest number of rainy days were at Bywell, 63; Allenheads 61; and Truro, Nottingham, and Hull, 58.

The least number of rainy days were at Holkham, 23; Norwich, 32; Cardington, 35; and Stockton and Bermerside, 36.

The heaviest falls of rain were at Truro, 12·87 inches; Guernsey, 12·83 inches; Helston, 12·62 inches; and Torquay, 12·40 in

The least falls of rain were at Norwich, 3·38 inches; Carlisle, 3·74 inches; and Leicester, 3·85 inches.

QUARTERLY METEOROLOGICAL TABLE for different PARALLELS of LATITUDE.

PARALLELS OF LATITUDE, &c.	Mean Pressure of dry Air reduced to the level of the Sea.	Mean of all Highest Readings of the Thermometer.	Mean of all Lowest Readings of the Thermometer.	Mean Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	WIND.					Mean Amount of Ozone.	Mean Amount of Cloud.
																		Mean Estimated Strength.	Relative Proportion of N.	E.	S.	W.		
	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°							
Guernsey	29·600	54·0	24·5	29·5	45·4	37·4	24·5	8·0	41·1	37·6	·226	2·6	0·4	87	548	–	–	1·7	8	9	7	7	3·8	7·
Between the latitudes 50° and 51°	29·636	58·9	19·5	39·4	45·2	34·8	29·5	10·4	39·6	36·5	·217	2·5	0·3	89	552	69·0	29·9	1·3	7	9	6	7	4·2	7·
51° and 52°	29·657	62·6	16·8	45·8	42·6	32·1	33·0	10·5	37·2	33·9	·197	2·3	0·3	88	552	65·9	28·2	1·2	7	9	7	7	2·1	7·
52° and 53°	29·648	60·8	15·0	45·8	41·8	30·8	33·8	11·0	36·1	33·3	·192	2·3	0·3	89	554	60·4	27·6	0·8	7	9	7	7	5·7	7·
53° and 54°	29·659	56·1	17·2	38·9	40·5	30·6	29·6	9·9	35·3	31·6	·179	2·1	0·4	86	553	57·4	27·0	1·0	7	10	6	6	4·3	7·
54° and 55°	29·641	56·1	13·7	42·4	41·3	29·8	33·1	11·5	35·2	31·1	·176	2·1	0·4	85	557	59·4	25·4	1·1	5	11	7	7	4·7	6·
Mean for the Quarter, 50° to 55° Year 1876	29·631	58·1	19·2	38·9	45·5	34·3	33·6	11·2	39·6	36·0	·212	2·5	0·4	87	551	68·3	30·7	1·4	6	6	8	10	4·2	6·
„ *1877*	29·556	58·0	21·7	36·3	48·3	36·7	31·8	11·6	42·4	38·3	·233	2·7	0·5	86	547	70·0	31·6	1·3	6	3	8	13	4·9	6·
„ *1878*	29·917	59·5	24·0	35·5	47·3	36·5	31·7	11·0	41·7	37·6	·228	2·6	0·5	86	554	70·0	31·8	1·1	8	4	6	12	4·1	6·
„ *1879*	29·648	58·9	16·4	42·5	42·3	31·6	31·8	10·7	36·6	33·3	·192	2·3	0·3	87	554	62·4	27·6	1·1	7	10	6	7	4·2	7·

METEOROLOGY OF ENGLAND,

DURING THE QUARTER ENDING JUNE 30, 1879.

REMARKS ON THE WEATHER DURING THE QUARTER ENDING JUNE 30TH, 1879.

By JAMES GLAISHER, ESQ., F.R.S., *&c.*

THE weather during the whole quarter has been cold, wet, and sunless, thus being a continuation without intermission of the weather which previously was prevalent.

During the quarter the temperatures of 17 days only were of their average or a little above their average values, all the rest were below, and at times very much below; on some days both in April and May the deficiency of temperature was as large as 10°, 11°, or 12°, and towards the end of June several days together were of lower temperature than their averages by 5° or 6°.

The mean deficiency for the 91 days in the quarter was 3°·36 on the average of the preceding 60 years.

The mean temperature of the quarter was 49°·5, the lowest since the very severe corresponding period in 1837, when it was 48°·3, and there have been nine instances only back to 1771 of such low temperatures, viz., in the years 1771, 1773, 1782, 1793, 1799, 1812, 1816, 1824, and 1837.

This unusually protracted bad weather set in on 27th October 1878; the weather in November and December was exceptionally severe, the mean temperature of these two months being 36°·7, a lower value than any experienced in this century, and back to 1771 the instances of somewhat lower temperatures were 1782, when it was 35°·4; 1784, 35°·8; 1786, 36°·3; 1788, 34°·8; and 1796, 35°·4.

The mean value for January was only 31°·9, being 5¼ nearly below the average of 60 years, and it is very remarkable that these three months should be of such low temperatures, as they have recently been from 2° to 3° of higher temperatures than they were a hundred years ago. The months of February and March were together but slightly below their averages, so that the mean temperature of the quarter ending March 31st, though low, viz., 37°·1, had been of lower value in twenty instances in the preceding 108 years.

With respect to the mean temperature of the eight months ending June 1879, viz. 41°·65, it is the lowest since the celebrated year of great frost, 1814, when it was still lower, viz., 40°·4; the instances back to 1771 are:

In 1783–1784	the mean temperatures	of eight months	ending June was	41°·3
1784–1785	„	„	„	41°·3
1788–1789	„	„	„	41°·2
1794–1795	„	„	„	40°·9
1796–1797	„	„	„	41°·3
1813–1814	„	„	„	40°·4
1815–1816	„	„	„	41°·71
1854–1855	„	„	„	41°·9
1878–1879	„	„	„	41°·65

Thus the temperature of these eight months in 1854–1855, and 1815–1816, was closely aproximate to that of the period we have just passed through; these are the only instances of so low a temperature in this century, excepting the lowest of all in 1814.

The weather following June in the years 1784 and 1785 was cold; in the year 1789 it was cold, excepting in December; in 1795 it was cold in July and November; in 1797 it was cold, excepting in July and December; in 1815 it was cold excepting for a very warm September; in 1855 it was moderately warm to October, and cold in November and December. Therefore, as a rule, the same cold weather has continued throughout the year.

The following table shows the mean temperature of the eight months ending June in every year from 1772–1879; by comparison of the results in the last column with those in the first, it will be at once seen how much higher the temperature has been in recent years than at the end of last century, and its progressive increase will be seen by comparing the numbers in the last column with those in the successive intermediate columns.

On comparing the last number 41°·65 with the numbers above it, the abnormal character of the weather this year with respect to temperature is at once evident.

TABLE showing the MEAN TEMPERATURE of the Eight Months NOVEMBER to JUNE from 1771—1772 to 1878—1879.

November to June.	Mean Temp. of the 8 months Nov. to June.	November to June.	Mean Temp. of the 8 months Nov. to June.	November to June.	Mean Temp. of the 8 months Nov. to June.	November to June.	Mean Temp. of the 8 months Nov. to June.	November to June.	Mean Temp. of the 8 months Nov. to June.	November to June.	Mean Temp. of the 8 months Nov. to June
Years.	°	Years.	°	Years.	°	Years.	°	Years.	°	Years.	°
1771—1772	42·2	1789—1790	44·2	1807—1808	42·9	1825—1826	45·1	1843—1844	46·1	1861—1862	45·6
1772—1773	42·9	1790—1791	44·7	1808—1809	44·5	1826—1827	43·4	1844—1845	42·5	1862—1863	46·3
1773—1774	43·5	1791—1792	42·9	1809—1810	43·8	1827—1828	46·2	1845—1846	48·2	1863—1864	45·3
1774—1775	45·8	1792—1793	43·2	1810—1811	45·0	1828—1829	44·4	1846—1847	43·8	1864—1865	45·3
1775—1776	43·3	1793—1794	45·5	1811—1812	43·3	1829—1830	42·9	1847—1848	47·2	1865—1866	46·3
1776—1777	43·7	1794—1795	40·9	1812—1813	43·3	1830—1831	44·9	1848—1849	46·1	1866—1867	45·5
1777—1778	44·1	1795—1796	45·5	1813—1814	40·4	1831—1832	44·9	1849—1850	45·3	1867—1868	46·3
1778—1779	47·3	1796—1797	41·3	1814—1815	44·9	1832—1833	45·6	1850—1851	45·9	1868—1869	45·9
1779—1780	44·3	1797—1798	45·4	1815—1816	41·71	1833—1834	47·5	1851—1852	44·5	1869—1870	44·8
1780—1781	44·6	1798—1799	42·2	1816—1817	43·9	1834—1835	45·6	1852—1853	45·8	1870—1871	43·8
1781—1782	42·7	1799—1800	42·7	1817—1818	45·1	1835—1836	43·9	1853—1854	44·2	1871—1872	43·6
1782—1783	42·4	1800—1801	45·0	1818—1819	46·4	1836—1837	42·4	1854—1855	41·9	1872—1873	45·2
1783—1784	41·2	1801—1802	43·2	1819—1820	43·1	1837—1838	43·1	1855—1856	41·0	1873—1874	45·9
1784—1785	41·3	1802—1803	43·1	1820—1821	43·9	1838—1839	43·0	1856—1857	45·0	1874—1875	44·3
1785—1786	42·3	1803—1804	46·0	1821—1822	48·4	1839—1840	45·0	1857—1858	45·9	1875—1876	44·4
1786—1787	43·1	1804—1805	43·0	1822—1823	43·4	1840—1841	44·0	1858—1859	46·5	1876—1877	46·3
1787—1788	44·8	1805—1806	45·0	1823—1824	43·0	1841—1842	45·4	1859—1860	43·4	1877—1878	46·8
1788—1789	41·2	1806—1807	45·8	1824—1825	45·5	1842—1843	45·3	1860—1861	44·0	1878—1879	41·65

The fall of rain in the quarter has been excessive, rain has fallen on 51 days, and the amount collected was 10·3 ins., the previous instances of such a large fall in the quarter are—in the year 1878, 13·2 ins., in the year 1860, 10·7 ins., and in 1821, 10·1 ins.; all other falls back to 1815 have been less than 10·0 ins.; this is remarkable by itself but becomes much more so when to the fall in the three preceding months, viz., 7·0 ins., is added, the total fall this year from January to June being 17·3 ins. greater in amount than in the same six months in any year back to 1815; in 1878 the fall in the same period was 16·3 ins., in 1866, 16·9 ins., in 1860, 15·5 ins., in 1824, 15·5 ins., and in 1819, 16·0 ins.

A great contrast to these heavy falls is that of 1870, when up to June the fall was 5·2 ins., of which only 1·1 in. fell in the months of April, May, and June. The average fall for the six months ending June is 10·8 ins.

Snow fell frequently, extending even to the south of England, in April, and occasionally during the first half of May.

The atmospheric pressure was a little above its average in May, but was a good deal below both in April and June; upon the whole quarter it was 0·12 in. daily too low; it was also a little above its average in January and March, but a good deal below in February, as well as in November and December; the average daily deficiency of atmospheric pressure from November to June is 0·13 in. daily.

Vegetation generally at the end of the quarter is fully a month or six weeks later than usual.

The readings of the barometer in the neighbourhood of London were below their averages from the 1st to the 27th of April, with the exception of two days, viz., 11th and 25th, which were 0·19 in. and 0·03 in., respectively, in excess; the mean amount of defect for the 27 days was 0·29 in. From the 28th of April till the 25th of May the mean daily readings were in excess of their averages, excepting on five days, viz., May 9th, 14th, 18th, 19th, and 25th, when they were slightly in defect, the mean amount of excess for the 28 days ending May 25th was 0·16 in. From the 26th of May till the end of the quarter (with the exception of five days) the barometer readings were all below their averages, the mean amount of defect for the 36 days ending June 30th was 0·18 in.

The mean reading of the barometer for the month of April was 29·520 ins., being 0·241 in. *below* the average, and back to 1841 there is but one instance of so low a reading for April, viz., in 1849, when it was 29·517 ins.

The mean reading for the month of May was 29·833 ins., being 0·052 in. above the average, and 0·215 in. above the value in 1878. The mean reading for the month of June was 29·641 ins., being 0·171 in. below the average, and lower than any value since 1852, when it was 29·560 ins.

The mean reading of the barometer for the quarter was 29·665 ins., being 0·120 in. below the average.

The atmospheric pressure in April was less than in March by 0·289 ins., in May was greater than in April by 0·313 in., and in June less than in May by 0·192 in. (From the preceding 38 years' observations the *mean pressure* in April is greater than in March by 0·021 in., that in May greater than in April by 0·020 in., and that in June is greater than in May by 0·031 in.) The mean *decrease* of pressure from March to April from all stations was 0·268 in., the mean *increase* from April to May was nearly the same everywhere, the general mean being 0·311 in., and the mean *decrease* from May to June from all places was 0·236 in.

At Greenwich the *mean temperature* of April was higher than that of March by 2°·0; that of May was higher than that of April by 5°·2, and that of June was higher than that of May by 8°·5. (From the preceding 38 years' observations the *mean temperature* of April is higher than that of March by 5°·6, that of May is higher than that of April by 5°·5, and that of June is higher than that of May by 6°·3.) The *increase* of mean temperature from March to April from all places was 1°·9; the *increase* from April to May was 5°·1, and the *increase* from May to June was 7°·5.

The mean temperature of the air for April was 43°·2, being 2°·9 and 4°·0, respectively, below the averages of the preceding 108 years, and 38 years. It was lower than any value back to 1860, when it was 42°·9.

The mean temperature of the air for May was 48°·4, being 4°·1 and 4°·3, respectively, below the averages of the preceding 108 years, and 38 years. In the preceding 108 years, there are but five instances of so low a mean temperature for the month of May; viz.—in the year 1773 it was 47°·5, in 1782 it was 48°·1, in 1783 it was 48°·3, in 1817 it was 47°·9, and in 1837 it was 47°·8.

The mean temperature of the air for June was 56°·9, being 1°·3 and 2°·1, respectively, below the averages of the preceding 108 years, and 38 years. It was lower than any value since 1871.

The mean temperature of the air for the quarter was 49°·5, being 2°·8 and 3°·5, respectively, below the averages of the preceding 108 years, and 38 years. The following are the only instances back to 1771 when the mean temperature of the three months ending June was as low as in the present year; viz.—49°·5. In 1771 it was 49°·1, in 1773 it was 49°·1, in 1782 it was 48°·9, in 1793 it was 49°·5, in 1799 it was 48°·9, in 1812 it was 48°·9, in 1816 it was 48°·4, in 1824 it was 49°·4, and in 1837 it was 48°·3.

The mean high day temperatures of the air were 5°·2, 5°·9, and 4°·2, respectively, below their averages in April, May, and June.

The mean low night temperatures of the air were 3°·0, 3°·8, and 0°·4, respectively, below their averages in April, May, and June. Therefore the days and nights were extremely cold throughout the quarter.

The mean daily ranges of temperature were 2°·2, 2°·1, and 3°·8, respectively, below their averages in April, May, and June.

The fall of rain at Greenwich in April was 2·6 ins., being 0·9 in. above the average; in May the fall was 3·4 ins., being 1·3 in. above the average; in June the fall was 4·3 ins., being 2·3 ins. above the average, and back to 1815 there are but four instances of so large a fall in June; viz., in 1838 it was 5·1 ins., in 1852 it was 4·6 ins., in 1860 it was 5·8 ins., and in 1878 it was 4·6 ins. The total fall in the quarter was 10·3 ins., being 4·5 ins. above the average, and back to 1815 there are but two instances of so large a fall; viz., in 1860 it was 10·7 ins., and in 1878 it was 13·2 ins.

1879. Months.	Temperature of										Elastic Force of Vapour.		Weight of Vapour in a Cubic Foot of Air.	
	Air.			Evaporation.		Dew Point.		Air—Daily Range.		Water of the Thames.				
	Mean.	Diff. from average of 108 years.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.		Mean.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.
	°	°	°	°	°	°	°	°	°	°	in.	in.	grs.	gr.
April -	43·2	−2·9	−4·0	40·7	−3·4	37·6	−3·0	16·3	−2·2	46·4	0·225	−0·029	2·6	−0·3
May -	48·4	−4·1	−4·3	44·7	−4·2	40·7	−4·5	18·3	−2·1	52·0	0·254	−0·046	2·9	−0·6
June -	56·9	−1·3	−2·1	53·8	−0·6	51·0	+0·4	17·4	−3·8	59·6	0·374	+0·004	4·2	+0·1
Means -	49·5	−2·8	−3·5	46·4	−2·7	43·1	−2·4	17·3	−2·7	52·7	0·284	−0·024	3·2	−0·3

1879. Months.	Degree of Humidity.		Reading of Barometer.		Weight of a Cubic Foot of Air.		Rain.		Daily Horizontal movement of the Air.	Reading of Thermometer on Grass.				
										Number of Nights it was			Lowest Reading at Night.	Highest Reading at Night.
	Mean.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.	Amount.	Diff. from average of 64 years.		At or below 30°.	Between 30° and 40°.	Above 40°.		
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
April -	81	+3	29·520	−0·241	544	+ 1	2·6	+0·9	229	8	20	2	24·0	40·5
May -	75	−1	29·833	+0·052	544	+ 3	3·4	+1·3	260	8	14	9	24·6	45·5
June -	80	+6	29·641	−0·171	531	− 1	4·3	+2·3	277	0	13	27	35·8	56·6
Means -	79	+3	29·665	−0·120	540	+ 1	Sum 10·3	Sum +4·5	Mean 255	Sum 16	Sum 37	Sum 38	Lowest 24·0	Highest 56·6

Note.—In reading this table it will be borne in mind that the plus sign (+) signifies *above* the average, and that the minus sign (−) signifies *below* the average.

The average duration of the different directions of the wind referred to eight points of the compass, and the duration of each direction in each month in the quarter were as follows:—

Direction of Wind.	April.			May.			June.		
	Average.	1879.	Departure from Average.	Average.	1879.	Departure from Average.	Average.	1879.	Departure from Average.
	d.	d.	d.	d.	d.	d.	d.	d.	d.
N.W.	2¼	3	+ ¾	1¼	4	+2¾	2	10	+8
N.	4	5	+1	4¼	5	+ ¾	3¼	1	−2¼
N.E.	6	4	−2	7	5	−2	3½	0	−3½
E.	3½	5	+1½	2½	3	+ ½	2½	1	−1½
S.E.	2	4	+2	1¾	2	+ ¼	1¾	2	+ ¼
S.	2½	4	+1½	2¼	2	− ¼	2¼	3	+ ¾
S.W.	6¼	3	−3¼	7½	4	−3½	10	5	−5
W.	2½	2	− ½	2	6	+4	3½	8	+4½
Calm (nearly.)	1	0	−1	2	0	−2	1½	0	−1½

The sign plus (+) denotes excesses over averages; the largest numbers affected with this sign in the month of April are opposite to the E., S.E., and S., in May and June to N.W. and W.

The sign minus (−) denotes defects below averages; the largest numbers affected with this sign in every month are opposite to N.E. and S.W.

Thunderstorms occurred on 5 days in April, 7 days in May, and on 13 days in June.

Thunder was heard but lightning was not seen on 10 days in both April and May, and on 15 days in June.

Lightning was seen but thunder was not heard on 3 days in April, one day in May, and on 9 days in June.

Solar halos were seen on 9 days in April, 5 days in May, and on 12 days in June.

Lunar halos were seen on 3 nights in April only.

Snow fell on 14 days in April (the falls being pretty general), and on 8 days in May.

Hail fell on 11 days in both April and May, and on 9 days in June.

Fog prevailed on 14 days in April, 21 days in May, and on 10 days in June.

MONTHLY METEOROLOGICAL TABLE FOR THE QUARTER ENDING JUNE 30TH, 1879.

The Observations have been reduced to Mean values by Glaisher's Barometrical and Diurnal Range Tables, and the Hygrometrical results have been deduced from the sixth edition of his Hygrometrical Tables.

NAMES of STATIONS and OBSERVERS.	Height of Station above Sea Level.	Year 1879.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.			Mean Degree of Humidity, Satn. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer.		Wind.					Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
								Mean						In a cubic foot of Air.							Relative Proportion of							
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.			Maximum in Rays of Sun.	Minimum on Grass.	Estimated Strength.	N.	E.	S.	W.			Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									
GUERNSEY, Samuel Elliott Hoskins, Esq., M.D., F.R.S., F.M.S.	204	April	29·462	1·410	55·5	34·5	21·0	51·1	41·1	10·0	45·2	40·5	·251	2·9	0·6	84	541	—	—	1·4	7	6	8	9	4·1	5·1	15	2·71
		May	29·805	1·048	62·5	37·0	25·5	54·2	43·3	10·9	47·7	43·7	·285	3·2	0·6	87	544	—	—	1·4	10	6	6	9	3·7	5·0	13	3·26
		June	29·612	0·668	67·5	45·0	22·5	60·7	49·2	11·5	54·0	50·4	·366	4·2	0·5	87	533	—	—	1·3	2	4	13	11	4·1	5·7	23	4·80
HELSTON (Cornwall), Matthew P. Moyle, Esq., M.R.C.S.	106	April	29·742	1·607	60·0	30·0	30·0	55·6	38·5	17·1	45·8	39·9	·246	2·8	0·7	80	545	70·9	35·1	1·6	10	5	6	9	3·9	3·4	15	2·76
		May	30·024	1·085	66·0	34·0	32·0	59·4	41·8	17·6	49·2	42·2	·270	3·0	1·0	77	546	72·6	41·4	1·8	12	4	5	10	4·1	4·6	12	1·80
		June	29·798	0·744	67·0	40·0	27·0	64·3	51·3	13·0	55·9	49·6	·339	4·0	1·0	81	535	79·3	49·3	2·3	2	3	14	11	5·7	5·6	25	5·38
TRURO (Cornwall), C. Barham, Esq., M.D., F.M.S.	43	April	29·647	1·555	60·0	24·0	36·0	54·0	38·3	15·7	44·0	42·4	·270	3·1	0·2	93	545	—	—	2·7	10	5	5	10	—	6·4	17	2·56
		May	29·994	1·050	64·0	31·0	33·0	57·2	43·8	13·4	48·2	45·3	·302	3·4	0·4	89	547	—	—	2·9	10	5	6	10	—	6·4	19	1·75
		June	29·724	0·712	68·0	38·0	30·0	62·9	51·7	11·2	54·0	51·6	·383	4·3	0·4	90	535	—	—	2·9	2	2	13	13	—	7·5	26	6·72
PLYMOUTH (Devon), John Merrifield, Esq., F.R.A.S., F.M.S., LL.D.	69	April	29·674	1·595	59·0	30·0	29·0	53·0	38·6	14·4	44·9	40·2	·249	2·9	0·5	84	545	—	38·0	1·4	7	8	8	8	—	6·5	16	2·66
		May	30·027	1·074	63·0	34·5	28·5	56·4	44·0	12·4	49·0	42·8	·276	3·1	0·9	79	547	—	42·6	1·5	9	6	6	10	—	6·6	20	2·19
		June	29·756	0·756	67·0	41·0	26·0	61·6	52·2	9·4	55·2	51·5	·381	4·3	0·7	88	534	—	—	1·8	2	2	16	10	—	8·6	25	5·90
TORQUAY, Babbacombe (Devon), Edwin E. Glyde, Esq., F.M.S.	305	April	29·350	1·570	57·9	30·8	27·1	51·1	38·3	12·8	43·7	38·3	·231	2·7	0·6	81	540	120·1	30·6	1·2	9	7	6	8	3·9	6·2	21	4·16
		May	29·690	1·071	63·0	35·0	28·0	55·3	43·1	12·2	47·9	41·8	·265	3·0	0·8	79	542	129·0	36·7	1·3	9	6	7	9	3·6	6·8	23	2·19
		June	29·474	0·721	69·2	41·9	27·3	61·2	50·2	11·0	54·6	50·8	·371	4·2	0·6	87	530	127·1	46·1	1·5	1	2	14	13	4·1	7·6	26	7·34
VENTNOR, Isle of Wight (Royal National Hospital for Consumption), Hartley Sagar, Esq.	150	April	29·624	1·424	57·8	28·7	29·1	50·4	40·0	10·4	43·7	40·0	·247	2·8	0·4	86	545	—	—	—	4	10	7	9	7·4	7·4	14	3·63
		May	29·971	0·940	65·5	32·0	33·5	56·9	42·8	14·1	48·2	43·6	·283	3·3	0·6	85	546	—	—	—	5	8	9	9	6·4	6·5	20	2·06
		June	29·772	0·628	64·2	45·0	19·2	60·6	51·1	9·5	54·3	51·9	·387	4·4	0·4	91	536	—	—	—	0	3	13	14	5·8	7·5	22	4·34
OSBORNE (Isle of Wight), R. J. Mann, Esq.	172	Apr.	29·496	1·406	60·8	28·8	32·0	53·1	38·3	14·8	43·6	41·0	·257	3·0	0·3	90	543	101·8	36·7	0·1	8	7	7	8	—	7·7	14	2·62
		May	29·825	0·974	70·0	33·5	36·5	60·2	43·1	17·1	49·0	44·0	·289	3·3	0·7	83	543	114·7	38·9	0·1	7	6	9	9	—	6·7	17	2·13
		June	29·630	0·638	70·7	43·7	27·0	64·2	52·2	12·0	55·7	52·4	·395	4·4	0·5	89	531	116·1	48·7	0·2	1	3	16	10	—	8·0	19	4·00
BOURNEMOUTH, South Bourne, (Hants), T. A. Compton, Esq., M.D., B.A., F.M.S.	95	April	29·535	1·420	55·9	27·0	28·9	49·1	37·4	11·7	42·6	37·8	·227	2·6	0·5	84	545	—	—	1·4	9	9	6	6	—	5·7	15	2·16
		May	29·887	0·940	62·9	29·7	33·2	54·8	41·5	13·3	47·3	41·0	·257	3·0	0·8	79	546	—	—	1·5	10	7	7	7	—	5·0	17	1·46
		June	29·705	0·632	67·6	43·7	23·9	59·3	51·6	7·7	54·4	50·0	·361	4·1	0·7	85	534	—	—	2·1	2	4	16	8	—	6·9	19	3·35
BRIGHTON (Sussex), F. E. Sawyer, Esq., F.M.S.	206	April	29·469	1·354	57·1	26·5	30·6	51·3	38·7	12·6	44·3	37·6	225	2·6	0·7	77	542	91·0	35·9	0·7	7	6	11	6	—	7·3	18	3·36
		May	29·788	0·988	67·0	31·0	36·0	57·8	41·6	16·2	48·6	41·3	·260	3·0	0·9	76	544	103·6	39·1	0·8	10	6	9	6	—	7·2	22	2·75
		June	29·612	0·666	73·0	42·4	30·6	66·9	51·5	15·4	57·4	52·1	·390	4·4	1·0	83	530	109·9	49·6	0·6	3	3	13	11	—	8·6	21	4·29
SALISBURY (Wilton House), Wilts, T. Challis, Esq.	186	April	29·485	1·450	61·0	25·0	36·0	53·7	33·3	20·4	42·8	38·5	·233	2·7	0·5	85	544	89·9	31·3	1·3	13	7	4	6	—	7·3	18	3·40
		May	29·808	0·988	70·0	26·0	44·0	57·6	38·3	19·3	49·2	43·6	·285	3·2	0·8	81	542	108·5	36·8	1·0	10	6	9	6	—	7·4	21	2·68
		June	29·598	0·673	73·0	37·0	36·0	66·0	47·3	18·7	55·2	49·8	·360	4·0	0·9	83	532	110·2	45·6	1·4	4	2	11	13	—	7·3	23	5·66
BARNSTAPLE (Devon), William Knill, Esq.	43	Apr.	29·646	1·620	62·0	27·0	35·0	54·5	39·5	15·0	45·5	41·6	·264	3·0	0·5	87	544	—	—	1·2	7	4	11	8	—	8·3	15	2·37
		May	29·982	0·980	68·0	33·0	35·0	59·7	44·3	15·4	50·4	44·9	·298	3·4	0·7	82	544	—	—	1·2	10	5	8	8	—	4·2	19	2·49
		June	29·748	0·760	71·0	41·0	30·0	66·4	53·1	13·3	57·5	53·9	·416	4·6	0·7	88	532	—	—	1·2	1	5	16	8	—	4·8	23	5·74

Meteorological Table, Quarter ending June 30th, 1879.

NAMES of STATIONS and OBSERVERS.	Height of Station above Sea Level.	Year 1879.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.			Mean Degree of Humidity. Satn. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer.		Wind.					Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
								Mean						In a Cubic foot of Air.							Relative Proportion of							
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.			Maximum in Rays of Sun.	Minimum on Grass.	Estimated Strength.	N.	E.	S.	W.			Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
CATERHAM (Surrey), The Metropolitan Asylum, JAMES ADAM, Esq., M.D.	608	April	29·009	1·350	59·0	25·0	34·0	49·5	35·5	14·0	41·4	37·8	·228	2·6	0·4	88	537	—	29·4	1·8	10	6	7	7	—	3·6	18	3·24
		May	29·351	0·890	65·0	28·0	37·0	54·6	38·5	16·1	45·9	40·6	·254	2·9	0·7	82	538	—	32·9	2·0	10	5	7	9	—	4·6	19	3·75
		June	29·177	0·810	65·8	39·3	26·5	61·2	47·8	13·4	53·7	50·0	·360	4·1	0·6	87	526	—	41·5	3·6	2	2	11	15	—	4·1	20	4·58
RAMSGATE (Kent), REV. E. DOUGLAS O'GARA, O.S.B., F.M.S.	108	April	29·588	1·309	59·5	31·7	27·8	50·8	38·9	11·9	43·7	38·7	·235	2·7	0·6	82	545	94·9	34·0	1·0	9	8	5	8	—	7·1	14	3·00
		May	29·905	0·937	68·4	34·6	33·8	56·9	42·0	14·9	48·0	43·4	·281	3·2	0·6	85	546	107·2	37·9	1·2	9	8	7	7	—	6·6	12	3·29
		June	29·737	0·793	75·2	42·8	32·4	65·9	50·5	15·4	56·3	51·1	·376	4·2	0·8	83	533	104·9	46·5	1·1	1	5	14	10	—	7·1	15	2·71
STRATHFIELD TURGISS (Hants), REV. C. H. GRIFFITH, M.A., F.M.S.	197	April	29·480	1·404	60·0	25·0	35·0	51·7	35·2	16·5	42·6	38·2	·231	2·7	0·4	85	544	100·5	28·6	1·0	8	4	8	10	1·5	7·5	18	3·29
		May	29·805	0·960	68·3	24·5	43·8	58·5	39·4	19·1	47·8	41·3	·260	3·0	0·7	79	544	111·1	33·9	1·2	12	5	6	8	1·6	7·9	15	3·61
		June	29·597	0·644	68·6	39·0	29·6	64·7	49·5	15·2	55·6	50·6	·369	4·1	0·8	84	531	117·3	45·4	1·2	1	3	14	12	2·5	8·2	24	5·06
WEYBRIDGE HEATH (Surrey), WILLIAM F. HARRISON, Esq., F.M.S.	150	April	29·554	1·371	62·3	24·0	38·3	53·3	34·5	18·8	43·3	38·2	·231	2·7	0·6	82	544	88·6	30·7	0·8	9	9	7	5	5·4	7·5	20	3·16
		May	29·875	0·986	70·5	25·5	45·0	59·0	38·6	20·4	48·5	41·8	·266	3·0	0·9	78	545	100·1	34·6	0·8	10	6	8	7	5·8	6·3	18	3·74
		June	29·684	0·705	74·8	38·8	36·0	68·0	48·1	19·9	56·6	50·5	·368	4·1	1·0	80	532	109·8	44·0	0·7	2	2	17	9	4·7	6·2	24	4·28
BATH (Somerset), St. Gregory's College, Downside, REV. T. L. ALMOND, O.S.B., F.M.S.	596	April	29·012	1·532	58·3	27·8	30·5	48·8	37·0	11·8	41·8	38·2	·231	2·7	0·4	88	536	90·1	31·1	1·5	9	5	7	9	—	7·3	18	3·69
		May	29·574	0·960	63·3	29·0	34·3	54·8	40·3	14·5	46·0	41·1	·259	3·0	0·6	84	538	103·4	36·2	1·5	9	6	7	9	—	7·1	21	3·83
		June	29·148	0·668	66·8	40·8	26·0	60·3	49·0	11·3	53·0	47·8	·332	3·7	0·8	82	526	111·0	45·5	1·9	2	3	12	13	—	7·5	25	6·05
MARLBOROUGH, (Wilts), REV. THOMAS A. PRESTON, M.A., F.M.S.	474	April	29·182	1·447	58·5	27·3	31·2	50·5	35·5	15·0	42·5	37·5	·225	2·6	0·5	85	536	65·3	28·4	0·7	8	9	6	7	—	6·6	16	3·39
		May	29·500	0·951	66·3	27·6	38·7	57·0	40·1	16·9	48·1	41·2	·258	3·0	0·9	77	538	109·4	35·0	0·6	10	7	6	8	—	6·8	19	3·44
		June	29·295	0·658	69·7	38·7	31·0	63·7	49·4	14·3	54·7	49·6	·354	4·0	0·8	83	527	111·5	45·1	—	3	3	13	11	—	7·9	25	4·97
BLACKHEATH (London), JAMES GLAISHER, Esq., F.R.S.	160	April	29·517	1·349	60·6	28·1	32·5	51·5	35·9	15·6	42·5	37·6	·224	2·6	0·6	83	545	94·3	32·4	0·6	9	9	7	5	—	7·7	18	2·64
		May	29·825	0·936	69·3	29·6	39·7	57·5	39·6	17·9	47·5	40·3	·250	2·9	0·9	77	545	110·3	35·7	0·8	9	7	5	10	—	6·0	17	3·37
		June	29·637	0·875	75·8	39·8	36·0	66·0	49·2	16·8	55·9	50·1	·363	4·1	0·9	82	532	123·5	45·4	1·1	6	2	7	15	—	6·7	18	4·16
STREATLEY (Berks), "The Vicarage," REV. J. SLATTER, M.A., F.R.S., F.M.S.	150	April	29·521	1·423	60·3	26·0	34·3	52·9	36·3	16·6	43·7	37·1	·221	2·6	0·6	77	544	—	—	1·3	10	11	5	4	—	6·6	18	2·43
		May	29·850	0·951	67·8	26·4	41·4	58·4	40·4	18·0	48·2	41·1	·257	2·9	0·9	78	545	—	—	1·2	10	7	6	8	—	7·1	22	3·44
		June	29·599	0·582	70·0	40·6	29·4	64·8	49·1	15·7	55·8	50·4	·307	4·1	0·9	83	531	—	—	2·1	2	3	13	12	—	7·8	22	3·23
CAMDEN SQUARE (London), G. J. SYMONS, Esq., F.R.S., F.M.S.	123	April	29·566	1·351	61·7	26·8	34·9	53·1	37·2	15·9	43·9	37·9	·227	2·6	0·7	79	544	92·5	34·3	—	9	7	7	7	—	7·0	16	2·72
		May	29·873	0·932	69·0	30·6	38·4	59·3	41·4	17·9	49·0	40·7	·255	2·9	1·1	73	544	105·8	37·6	—	14	4	5	8	—	6·4	19	3·46
		June	29·696	0·715	74·0	40·6	33·4	67·1	50·6	16·5	57·1	50·4	·366	4·1	1·5	78	532	112·3	47·1	—	3	2	14	11	—	6·8	22	4·76
OXFORD (The Observatory), E. J. STONE, Esq., M.A., F.R.S.	210	April	29·478	1·442	58·1	27·1	31·0	49·5	36·3	13·2	42·8	38·4	·233	2·7	0·4	85	544	92·1	33·2	0·9	11	5	8	6	1·3	8·4	16	2·45
		May	29·780	0·932	64·7	29·5	35·2	55·2	41·4	13·8	48·2	43·0	·276	3·2	0·6	82	543	105·9	37·5	1·2	9	5	7	10	1·6	7·7	16	2·71
		June	29·562	0·684	68·1	40·4	27·7	62·7	50·4	12·3	56·0	52·3	·394	4·4	0·6	88	530	109·0	44·6	1·3	1	3	14	12	1·0	8·5	27	4·54
ROYSTON (Hertfordshire), HALE WORTHAM, Esq., F.R.A.S., F.M.S.	269	April	29·429	1·360	62·1	24·1	38·0	51·6	33·8	17·8	41·4	38·4	·233	2·7	0·4	90	544	—	—	—	11	6	7	6	—	7·5	16	2·59
		May	29·749	0·891	70·1	26·0	44·1	57·9	38·1	19·8	46·9	41·2	·258	3·0	0·7	81	544	—	—	—	11	5	8	7	—	6·5	15	3·00
		June	29·550	0·673	73·0	38·7	34·3	66·6	47·8	18·8	55·2	52·0	·390	4·4	0·5	89	531	—	—	—	3	3	14	10	—	7·7	23	5·10
BEDFORD, Cardington, MR. J. MACLAREN, Assistant to S. C. WHITBREAD, Esq., F.R.S.	105	April	29·554	1·384	61·4	28·0	33·4	51·8	35·1	16·2	42·0	39·3	·241	2·8	0·3	90	546	82·1	31·1	1·1	8	9	6	7	—	7·5	14	1·80
		May	29·878	0·910	68·6	26·6	42·0	58·1	39·5	18·6	47·6	40·9	·256	3·0	0·8	78	546	96·4	34·4	1·7	13	5	7	6	—	7·0	16	3·25
		June	29·648	0·690	73·0	39·0	34·0	67·5	49·6	17·9	56·8	53·6	·411	4·6	0·6	89	531	106·7	46·8	1·6	2	4	10	14	—	7·8	24	4·35
CAMBRIDGE (Trinity College), J. W. L. GLAISHER, Esq., M.A., F.R.S.	40	April	29·615	1·374	62·8	28·0	34·8	52·2	35·8	16·4	42·6	38·5	·233	2·7	0·5	86	546	111·1	31·2	1·3	9	8	8	5	—	7·7	21	2·18
		May	29·936	0·919	72·1	25·8	46·3	59·3	39·7	19·6	47·8	42·1	·268	3·1	0·7	82	546	124·7	33·8	1·3	9	9	6	7	—	6·8	19	3·32
		June	29·722	0·672	75·8	38·0	37·8	67·7	49·7	18·0	56·8	52·3	·391	4·4	0·8	85	532	132·1	45·0	1·4	3	3	15	9	—	7·2	26	5·22
RUGBY (Warwickshire), Stockton, "The Rectory," W. TUCKWELL, Esq.	289	April	29·565	1·549	59·5	24·0	35·5	51·2	33·6	17·6	41·0	38·5	·233	2·7	0·3	91	544	60·7	31·7	0·4	10	10	6	4	6·0	7·0	18	2·56
		May	29·667	1·186	67·0	21·0	46·0	57·4	37·9	19·5	46·6	43·2	·280	3·2	0·5	89	548	70·1	35·4	0·4	12	6	7	6	6·2	6·7	15	2·55
		June	29·458	0·635	71·2	35·0	36·2	65·2	47·1	18·1	55·2	52·1	·388	4·4	0·8	89	529	80·1	45·8	0·5	2	5	15	8	7·3	7·4	—	—
LOWESTOFT (Suffolk), S. H. MILLER, Esq., F.R.A.S., F.M.S.	85	April	29·572	1·348	57·3	29·3	28·0	47·6	36·3	11·3	41·1	36·4	·214	2·5	0·5	83	547	89·2	34·1	0·3	9	11	5	5	—	7·1	19	2·19
		May	29·881	0·904	61·2	31·3	29·9	53·0	40·5	12·5	46·5	38·7	·235	2·7	0·9	75	547	104·3	37·8	0·3	8	8	8	7	—	6·9	13	1·89
		June	29·604	0·758	69·9	41·0	28·9	61·9	49·4	12·5	54·9	48·6	·342	3·9	1·0	79	534	112·1	47·0	0·5	2	4	8	17	—	6·7	20	2·10

MONTHLY METEOROLOGICAL TABLE FOR THE QUARTER ENDING JUNE 30TH, 1879.

The Observations have been reduced to Mean values by Glaisher's Barometrical and Diurnal Range Tables, and the Hygrometrical results have been deduced from the sixth edition of his Hygrometrical Tables.

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1879.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.			Mean Degree of Humidity. Satn. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer.		Wind.					Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
								Mean						In a cubic foot of Air.							Relative Proportion of							
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.			Maximum in Rays of Sun.	Minimum on Grass.	Estimated Strength.	N.	E.	S.	W.			Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									
GUERNSEY, Samuel Elliott Hoskins, Esq., M.D., F.R.S., F.M.S.	204	April	29·462	1·410	55·5	34·5	21·0	51·1	41·1	10·0	45·2	40·5	·251	2·9	0·6	84	541	–	–	1·4	7	6	8	9	4·1	5·1	15	2·71
		May	29·805	1·048	62·5	37·0	25·5	54·2	43·3	10·9	47·7	43·7	·285	3·2	0·6	87	544	–	–	1·4	10	6	6	9	3·7	5·0	13	3·26
		June	29·612	0·668	67·5	45·0	22·5	60·7	49·2	11·5	54·0	50·4	·366	4·2	0·5	87	533	–	–	1·3	2	4	13	11	4·1	5·7	23	4·80
HELSTON (Cornwall), Matthew P. Moyle, Esq., M.R.C.S.	106	April	29·742	1·607	60·0	30·0	30·0	55·6	38·5	17·1	45·8	39·9	·246	2·8	0·7	80	545	70·9	35·1	1·6	10	5	6	9	3·9	3·4	15	2·76
		May	30·024	1·085	66·0	34·0	32·0	59·4	41·8	17·6	49·2	42·2	·270	3·0	1·0	77	546	72·6	41·4	1·8	12	4	5	10	4·1	4·6	12	1·80
		June	29·798	0·744	67·0	40·0	27·0	64·3	51·3	13·0	55·9	49·6	·359	4·0	1·0	81	535	79·3	49·3	2·3	2	3	14	11	5·7	5·6	25	5·38
TRURO (Cornwall), C. Barham, Esq., M.D., F.M.S.	45	April	29·647	1·555	60·0	24·0	36·0	54·0	38·3	15·7	44·0	42·4	·270	3·1	0·2	93	545	–	–	2·7	10	5	5	10	–	6·4	17	2·56
		May	29·994	1·050	64·0	31·0	33·0	57·2	43·8	13·4	48·2	45·3	·302	3·4	0·4	89	547	–	–	2·9	10	5	6	10	–	6·4	19	1·75
		June	29·724	0·712	68·0	38·0	30·0	62·9	51·7	11·2	54·0	51·6	·383	4·3	0·4	90	535	–	–	2·9	2	2	13	13	–	7·5	26	6·72
PLYMOUTH (Devon), John Merrifield, Esq., F.R.A.S., F.M.S., LL.D.	69	April	29·674	1·595	59·0	30·0	29·0	53·0	38·6	14·4	44·9	40·2	·249	2·9	0·5	84	545	–	38·0	1·4	7	8	8	8	–	6·5	16	2·66
		May	30·027	1·074	63·0	34·5	28·5	56·4	44·0	12·4	49·0	42·8	·276	3·1	0·9	79	547	–	42·6	1·5	9	6	6	10	–	6·6	20	2·19
		June	29·756	0·756	67·0	41·0	26·0	61·6	52·2	9·4	55·2	51·5	·381	4·3	0·7	88	534	–	–	1·8	2	2	16	10	–	8·6	25	5·90
TORQUAY, Babbacombe (Devon), Edwin E. Glyde, Esq., F.M.S.	305	April	29·350	1·570	57·9	30·8	27·1	51·1	38·3	12·8	43·7	38·3	·231	2·7	0·6	81	540	120·1	30·6	1·2	9	7	6	8	3·9	6·2	21	4·16
		May	29·690	1·071	63·0	35·0	28·0	55·3	43·1	12·2	47·9	41·8	·265	3·0	0·8	79	542	129·0	36·7	1·3	9	6	7	9	3·6	6·8	23	2·19
		June	29·474	0·721	69·2	41·9	27·3	61·2	50·2	11·0	54·6	50·8	·371	4·2	0·6	87	530	127·1	46·1	1·5	1	2	14	13	4·1	7·6	26	7·34
VENTNOR, Isle of Wight (Royal National Hospital for Consumption), Hartley Sagar, Esq.	150	April	29·624	1·424	57·8	28·7	29·1	50·4	40·0	10·4	43·7	40·0	·247	2·8	0·4	86	545	–	–	–	4	10	7	9	7·4	7·4	14	3·63
		May	29·971	0·940	65·5	32·0	33·5	56·9	42·8	14·1	48·2	43·6	·283	3·3	0·6	85	544	–	–	–	5	8	9	9	6·4	6·5	20	2·06
		June	29·772	0·628	64·2	45·0	19·2	60·6	51·1	9·5	54·3	51·9	·387	4·4	0·4	91	536	–	–	–	0	3	13	14	5·8	7·5	22	4·34
OSBORNE (Isle of Wight), R. J. Mann, Esq.	172	Apr.	29·496	1·406	60·8	28·8	32·0	53·1	38·3	14·8	43·6	41·0	·257	3·0	0·3	90	543	101·8	36·7	0·1	8	7	7	8	–	7·7	14	2·62
		May	29·825	0·974	70·0	33·5	36·5	60·2	43·1	17·1	49·0	44·0	·289	3·3	0·7	83	543	114·7	38·9	0·1	7	6	9	9	–	6·7	17	2·12
		June	29·630	0·658	70·7	43·7	27·0	64·2	52·2	12·0	55·7	52·4	·395	4·4	0·5	89	531	116·1	48·7	0·2	1	3	16	10	–	8·0	19	4·00
BOURNEMOUTH, South Bourne, (Hants), T. A. Compton, Esq., M.D., B.A., F.M.S.	95	April	29·535	1·420	55·9	27·0	28·9	49·1	37·4	11·7	42·6	37·8	·227	2·6	0·5	84	545	–	–	1·4	9	9	6	6	–	5·7	15	2·16
		May	29·887	0·940	62·9	29·7	33·2	54·8	41·5	13·3	47·3	41·0	·257	3·0	0·8	79	546	–	–	1·5	10	7	7	7	–	5·0	17	1·46
		June	29·705	0·632	67·6	43·7	23·9	59·3	51·6	7·7	54·4	50·0	·361	4·1	0·7	85	534	–	–	2·1	2	4	16	8	–	6·9	19	3·35
BRIGHTON (Sussex), F. E. Sawyer, Esq., F.M.S.	206	April	29·469	1·354	57·1	26·5	30·6	51·3	38·7	12·6	44·3	37·6	·225	2·6	0·7	77	542	91·0	35·9	0·7	7	6	11	6	–	7·3	18	3·36
		May	29·788	0·988	67·0	31·0	36·0	57·8	41·6	16·2	48·6	41·3	·260	3·0	0·9	76	544	103·6	39·1	0·8	10	6	9	6	–	7·2	22	2·75
		June	29·612	0·666	73·0	42·4	30·6	66·9	51·5	15·4	57·4	52·1	·390	4·4	1·0	83	530	109·9	49·6	0·6	3	3	13	11	–	8·6	21	4·29
SALISBURY (Wilton House), Wilts, T. Challis, Esq.	186	April	29·485	1·450	61·0	25·0	36·0	53·7	33·3	20·4	42·8	38·5	·233	2·7	0·5	85	544	89·9	31·3	1·3	13	7	4	6	–	7·3	18	3·40
		May	29·808	0·988	70·0	26·0	44·0	57·6	38·3	19·3	49·2	43·6	·285	3·2	0·8	81	542	108·5	36·8	1·0	10	6	9	6	–	7·4	21	2·68
		June	29·598	0·673	73·0	37·0	36·0	66·0	47·3	18·7	55·2	49·8	·360	4·0	0·9	83	532	110·2	45·6	1·4	4	2	11	13	–	7·3	23	5·66
BARNSTAPLE (Devon), William Knill, Esq.	43	Apr.	29·646	1·620	62·0	27·0	35·0	54·5	39·5	15·0	45·5	41·6	·264	3·0	0·5	87	544	–	–	1·2	7	4	11	8	–	8·3	15	2·37
		May	29·982	0·980	68·0	33·0	35·0	59·7	44·3	15·4	50·4	44·9	·298	3·4	0·7	82	544	–	–	1·2	10	5	8	8	–	4·2	19	2·49
		June	29·748	0·760	71·0	41·0	30·0	66·4	53·1	13·3	57·5	53·9	·416	4·6	0·7	88	532	–	–	1·2	1	5	16	8	–	4·8	23	5·74

Meteorological Table, Quarter ending June 30th, 1879.

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1879.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.			Mean Degree of Humidity, Satn. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer.		Wind.					Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
								Mean						In a Cubic foot of Air.							Relative Proportion of							
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.			Maximum in Rays of Sun.	Minimum on Grass.	Estimated Strength.	N.	E.	S.	W.			Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
CATERHAM (Surrey), The Metropolitan Asylum, James Adam, Esq., M.D.	608	April	29·009	1·350	59·0	25·0	34·0	49·5	35·5	14·0	41·4	37·8	·228	2·6	0·4	88	537	—	29·4	1·8	10	6	7	7	—	3·6	18	3·24
		May	29·351	0·890	65·0	28·0	37·0	54·6	38·5	16·1	45·9	40·6	·254	2·9	0·7	82	538	—	32·9	2·0	10	5	7	9	—	4·6	19	3·75
		June	29·177	0·810	65·8	29·3	26·5	61·2	47·8	13·4	53·7	50·0	·360	4·1	0·6	87	526	—	41·5	3·6	2	2	11	15	—	4·1	20	4·58
RAMSGATE (Kent), Rev. E. Douglas O'Gara, O.S.B., F.M.S.	108	April	29·588	1·309	59·5	31·7	27·8	50·8	38·9	11·9	43·7	38·7	·235	2·7	0·6	82	545	94·9	34·0	1·0	9	8	5	8	—	7·1	14	3·00
		May	29·905	0·957	68·4	34·6	33·8	56·9	42·0	14·9	48·0	43·4	·281	3·2	0·6	85	546	107·2	37·9	1·2	9	8	7	7	—	6·6	12	3·29
		June	29·737	0·793	75·2	42·8	32·4	65·9	50·5	15·4	56·3	51·1	·376	4·2	0·8	83	533	104·9	46·5	1·1	1	5	14	10	—	7·1	15	2·71
STRATHFIELD TURGISS (Hants), Rev. C. H. Griffith, M.A., F.M.S.	197	April	29·480	1·404	60·0	25·0	35·0	51·7	35·2	16·5	42·6	38·2	·231	2·7	0·4	85	544	100·5	28·6	1·0	8	4	8	10	1·5	7·5	18	3·29
		May	29·805	0·930	68·3	24·5	43·8	58·5	39·4	19·1	47·8	41·3	·260	3·0	0·7	79	544	111·1	33·9	1·2	12	5	6	8	1·6	7·9	15	3·61
		June	29·597	0·644	68·6	39·0	29·6	64·7	49·5	15·2	55·6	50·0	·369	4·1	0·8	84	531	117·3	45·4	1·2	1	3	14	12	2·5	8·2	24	5·06
WEYBRIDGE HEATH (Surrey), William F. Harrison, Esq., F.M.S.	150	April	29·554	1·371	62·3	24·0	38·3	53·3	34·5	18·8	43·3	38·2	·231	2·7	0·6	82	544	88·6	30·7	0·8	9	9	7	5	5·4	7·5	20	3·16
		May	29·875	0·986	70·5	25·5	45·0	59·0	38·6	20·4	48·5	41·8	·266	3·0	0·9	78	545	100·1	34·6	0·8	10	6	8	7	5·8	6·3	18	3·74
		June	29·684	0·705	74·8	38·8	36·0	68·0	48·1	19·9	56·6	50·5	·368	4·1	1·0	80	532	109·8	44·0	0·7	2	2	17	9	4·7	6·2	24	4·28
BATH (Somerset), St. Gregory's College, Downside, Rev. T. L. Almond, O.S.B., F.M.S.	596	April	29·012	1·532	58·3	27·8	30·5	48·8	37·0	11·8	41·8	38·2	·231	2·7	0·4	88	526	90·1	31·1	1·5	9	5	7	9	—	7·3	18	3·69
		May	29·374	0·960	63·3	29·0	34·3	54·8	40·3	14·5	46·0	41·1	·259	3·0	0·6	84	538	103·4	36·2	1·5	9	6	7	9	—	7·1	21	3·83
		June	29·148	0·668	66·8	40·8	26·0	60·3	49·0	11·3	53·0	47·8	·332	3·7	0·8	82	526	111·0	45·5	1·9	2	3	12	13	—	7·5	25	6·05
MARLBOROUGH, (Wilts), Rev. Thomas A. Preston, M.A., F.M.S.	474	April	29·182	1·447	58·5	27·3	31·2	50·5	35·5	15·0	42·5	37·5	·225	2·6	0·5	85	536	65·3	28·4	0·7	8	9	6	7	—	6·6	16	3·39
		May	29·590	0·951	66·3	27·6	38·7	57·0	40·1	16·9	48·1	41·2	·258	3·0	0·9	77	538	109·4	35·0	0·6	10	7	6	8	—	6·8	19	3·44
		June	29·295	0·658	69·7	38·7	31·0	63·7	49·4	14·3	54·7	49·6	·354	4·0	0·8	83	527	111·5	45·1	—	3	3	13	11	—	7·9	25	4·97
BLACKHEATH (London), James Glaisher, Esq., F.R.S.	160	April	29·517	1·349	60·6	28·1	32·5	51·5	35·9	15·6	42·5	37·6	·224	2·6	0·6	83	545	94·3	32·4	0·6	9	9	7	5	—	7·7	18	2·64
		May	29·825	0·936	69·3	29·6	39·7	57·5	39·6	17·9	47·5	40·3	·250	2·9	0·9	77	545	110·3	35·7	0·8	9	7	5	10	—	6·0	17	3·37
		June	29·637	0·875	75·8	39·8	36·0	66·0	49·2	16·8	55·9	50·1	·363	4·1	0·9	82	532	123·5	45·4	1·1	6	2	7	15	—	6·7	18	4·16
STREATLEY (Berks), "The Vicarage," Rev. J. Slatter, M.A., F.R.S., F.M.S.	150	April	29·521	1·423	60·3	26·0	34·3	52·9	36·3	16·6	43·7	37·1	·221	2·6	0·6	77	544	—	—	1·3	10	11	5	4	—	6·6	18	2·43
		May	29·856	0·951	67·8	26·4	41·4	58·4	40·4	18·0	48·2	41·1	·257	2·9	0·9	78	545	—	—	1·2	10	7	6	8	—	7·1	22	3·44
		June	29·594	0·582	70·0	40·6	29·4	64·8	49·1	15·7	55·8	50·4	·367	4·1	0·9	83	531	—	—	2·1	2	3	13	12	—	7·8	22	3·23
CAMDEN SQUARE (London), G. J. Symons, Esq., F.R.S., F.M.S.	123	April	29·566	1·351	61·7	26·8	34·9	53·1	37·2	15·9	43·9	37·9	·227	2·6	0·7	79	544	92·5	34·3	—	9	7	7	7	—	7·0	16	2·72
		May	29·873	0·932	69·0	30·6	38·4	59·3	41·4	17·9	49·0	40·7	·255	2·9	1·1	73	544	105·5	37·6	—	14	4	5	8	—	6·4	19	3·46
		June	29·696	0·715	74·0	40·6	33·4	67·1	50·6	16·5	57·1	50·4	·366	4·1	1·5	78	532	112·3	47·1	—	3	2	14	11	—	6·8	22	4·76
OXFORD (The Observatory), E. J. Stone, Esq., M.A., F.R.S.	210	April	29·478	1·442	58·1	27·1	31·0	49·5	36·3	13·2	42·8	38·4	·233	2·7	0·4	85	544	92·1	33·2	0·9	11	5	8	6	1·3	8·4	16	2·45
		May	29·780	0·932	64·7	29·5	35·2	55·2	41·4	13·8	48·2	43·0	·276	3·2	0·6	82	543	105·9	37·5	1·2	9	5	7	10	1·6	7·7	16	2·71
		June	29·562	0·684	68·1	40·4	27·7	62·7	50·4	12·3	56·0	52·3	·394	4·4	0·6	88	530	109·0	44·6	1·3	1	3	14	12	1·0	8·5	27	4·54
ROYSTON (Hertfordshire), Hale Wortham, Esq., F.R.A.S., F.M.S.	269	April	29·429	1·369	62·1	24·1	38·0	51·6	33·8	17·8	41·4	38·4	·233	2·7	0·4	90	544	—	—	—	11	6	7	6	—	7·5	16	2·59
		May	29·749	0·891	70·1	26·0	44·1	57·9	38·1	19·8	46·9	41·2	·258	3·0	0·7	81	544	—	—	—	11	5	8	7	—	6·5	15	3·00
		June	29·550	0·673	73·0	38·7	34·3	66·6	47·8	18·8	55·2	52·0	·390	4·4	0·5	89	531	—	—	—	3	3	14	10	—	7·7	23	5·10
BEDFORD, Cardington, Mr. J. MacLaren, Assistant to S. C. Whitbread, Esq., F.R.S.	105	April	29·554	1·384	61·4	28·0	33·4	51·3	35·1	16·2	42·0	39·3	·241	2·8	0·3	90	546	82·1	31·1	1·1	8	9	6	7	—	7·5	14	1·80
		May	29·878	0·910	68·6	26·6	42·0	58·1	39·5	18·6	47·6	40·9	·266	3·0	0·8	78	546	96·4	34·4	1·7	13	5	7	6	—	7·0	16	3·25
		June	29·648	0·690	73·0	39·0	34·0	67·5	49·6	17·9	56·8	53·6	·411	4·6	0·6	89	531	106·7	46·8	1·6	2	4	10	14	—	7·8	24	4·55
CAMBRIDGE (Trinity College), J. W. L. Glaisher, Esq., M.A., F.R.S.	40	April	29·615	1·374	62·8	28·0	34·8	52·2	35·8	16·4	42·6	38·5	·233	2·7	0·5	86	546	111·1	31·2	1·3	9	8	8	5	—	7·7	21	2·18
		May	29·936	0·919	72·1	25·8	46·3	59·3	39·7	19·6	47·8	42·1	·268	3·1	0·7	82	546	124·7	33·8	1·3	9	9	6	7	—	6·8	19	3·32
		June	29·722	0·672	75·8	38·0	37·8	67·7	49·7	18·0	56·8	52·3	·391	4·4	0·8	85	532	132·1	45·0	1·4	3	3	15	9	—	7·2	26	5·22
RUGBY (Warwickshire), Stockton, "The Rectory," W. Tuckwell, Esq.	280	April	29·765	1·549	59·5	24·0	35·5	51·2	33·6	17·6	41·0	38·5	·233	2·7	0·3	91	544	60·7	31·7	0·4	10	10	6	4	6·0	7·0	18	2·56
		May	29·667	1·186	67·0	21·0	46·0	57·4	37·9	19·5	46·6	43·2	·280	3·2	0·5	89	543	70·1	35·4	0·4	12	6	7	6	6·2	6·7	15	2·55
		June	29·458	0·635	71·2	35·0	36·2	65·2	47·1	18·1	55·2	52·1	·388	4·4	0·8	89	529	80·1	45·8	0·5	2	5	15	8	7·3	7·4	—	—
LOWESTOFT (Suffolk), G. H. Miller, Esq., F.R.A.S.,	85	April	29·572	1·348	57·3	29·3	28·0	47·6	36·3	11·3	41·1	36·4	·214	2·5	0·5	83	547	89·2	34·1	0·3	9	11	5	5	—	7·1	10	2·19
		May	29·881	0·904	61·2	31·3	29·9	53·0	40·5	12·5	46·5	38·7	·235	2·7	0·9	75	547	104·3	37·8	0·3	8	8	8	7	—	6·9	13	1·89
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1·0	79	534	112·1	47·0	0·5	2	4	8	17	—	6·7	20	2·10

NAMES OF STATIONS.	Mean Pressure of dry Air reduced to the level of the Sea.	Highest Reading of the Thermometer.	Lowest Reading of the Thermometer.	Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	WIND. Mean Estimated Strength.	WIND. Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	RAIN. Number of Days on which it fell.
	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°								
Guernsey - - -	29·547	67·5	34·5	33·0	55·3	44·5	23·0	10·8	49·0	44·9	·301	3·4	0·6	86	539	—	—	1·4	6	5	9	10	4·0	5·8	51
Helston - - - -	—	67·0	30·0	37·0	59·8	44·9	29·7	15·9	50·3	44·1	·292	3·8	0·9	79	542	74·3	41·9	1·9	8	4	8	10	4·6	4·5	32
Truro - - - -	29·517	68·0	24·0	44·0	58·0	44·6	37·0	13·4	48·7	46·4	·318	3·6	0·5	91	512	—	—	2·8	7	4	8	11	—	6·8	62
Plymouth - - -	29·539	67·0	30·0	37·0	57·0	44·9	27·8	12·1	49·7	44·8	·302	3·4	0·7	84	512	—	—	1·6	6	5	10	9	—	7·2	61
Torquay - - -	29·549	69·2	30·8	38·4	55·9	43·9	27·5	12·0	48·7	45·6	·293	3·5	0·7	82	537	123·4	37·8	1·3	6	5	9	10	3·9	6·9	70
Ventnor - - -	29·592	65·5	28·7	36·8	57·0	44·6	27·5	11·4	48·7	45·2	·30[illegible]	3·5	0·5	87	542	—	—	—	3	7	10	11	6·5	7·1	55
Osborne - - -	29·523	70·7	28·8	41·9	59·2	44·5	31·8	14·7	49·4	45·8	·314	3·6	0·5	87	529	110·9	41·4	0·1	5	5	11	9	—	7·3	50
Bournemouth - -	29·529	67·6	27·0	40·6	54·4	43·[illegible]	28·7	10·9	48·1	42·9	·282	3·2	0·7	83	542	—	—	1·7	7	7	10	7	—	5·9	51
Brighton - - -	29·549	73·0	26·5	46·5	58·7	43·9	32·4	14·8	50·1	43·7	·292	3·3	0·9	79	539	101·5	41·5	0·7	7	5	11	8	—	7·7	61
Salisbury - - -	29·543	73·0	25·0	48·0	59·1	39·6	38·7	19·5	49·1	44·0	·29[illegible]	3·3	0·7	83	539	102·9	37·1	1·2	9	5	8	8	—	7·5	62
Barnstaple - -	29·515	71·0	27·0	44·0	59·2	45·6	43·3	14·6	51·1	46·8	·325	3·7	0·6	86	540	—	—	1·2	6	5	12	8	—	4·1	57
Bath - - - -	29·534	66·8	27·8	39·0	54·6	42·1	30·5	12·5	46·9	42·4	·274	3·1	0·6	85	533	101·5	37·6	1·6	7	5	9	10	—	7·3	64
Caterham - - -	29·618	65·8	25·0	40·8	55·1	40·6	32·5	14·5	47·0	42·6	·281	3·1	0·6	86	534	—	34·6	2·5	7	4	8	10	—	4·1	57
Ramsgate - - -	29·564	75·2	31·7	43·5	57·9	43·8	31·3	14·1	49·3	44·4	·297	3·4	0·7	83	541	102·5	39·5	1·1	6	7	9	8	—	6·9	41
Strathfield Turgiss -	29·555	68·6	24·5	44·1	58·5	41·4	34·1	16·9	48·7	43·4	·287	3·1	0·6	83	540	100·[illegible]	36·0	1·1	7	4	9	10	1·9	7·9	57
Weybridge Heath -	29·581	74·8	24·0	50·8	60·1	40·4	39·8	19·7	49·5	43·5	·288	3·[illegible]	0·8	84	540	99·5	36·4	0·8	7	6	11	7	5·5	6·7	62
Marlborough - -	29·547	69·7	27·3	42·4	57·1	41·7	33·6	15·4	48·4	42·8	·279	3·1	0·7	82	534	95·4	36·2	—	7	6	8	9	—	7·1	60
Blackheath - -	29·555	75·8	28·1	47·7	58·3	41·6	36·1	16·7	48·6	42·7	·275	3·1	0·8	81	541	109·4	37·8	0·8	8	6	6	10	—	6·8	55
Streatley - - -	29·547	70·0	26·0	44·0	58·7	41·9	35·0	16·8	49·2	42·9	·282	3·1	0·8	79	540	—	—	1·5	7	7	8	8	—	7·1	62
Camden Square -	29·559	74·0	26·8	47·2	59·8	43·1	35·[illegible]	16·7	50·0	43·0	·283	3·2	1·1	77	540	103·4	39·7	—	9	4	9	9	—	6·7	57
Oxford - - -	29·536	68·1	27·1	41·0	55·8	42·7	31·[illegible]	13·1	49·0	44·6	·291	3·4	0·5	85	539	102·5	38·3	1·1	7	4	10	9	1·3	8·2	59
Royston - - -	29·572	73·0	24·1	48·9	58·7	39·9	38·8	18·8	47·8	43·[illegible]	·2[illegible]4	3·4	0·5	87	540	—	—	—	8	5	10	8	—	7·2	54
Cardington - -	29·500	73·0	26·6	46·4	59·0	41·4	36·[illegible]	17·[illegible]	48·8	44·6	·30[illegible]	3·5	0·[illegible]	84	541	93·1	37·4	1·5	8	6	8	9	—	7·4	54
Cambridge - -	29·505	75·8	25·8	50·0	59·7	41·7	39·6	18·0	49·1	44·5	·297	3·4	0·7	84	541	122·6	36·7	1·3	7	7	10	7	—	7·2	66
Stockton - - -	29·514	71·2	21·0	50·2	57·9	39·5	39·2	18·4	47·6	44·1	·300	3·4	0·5	90	539	70·8	37·6	0·4	8	7	9	6	6·5	7·0	—
Lowestoft - - -	29·545	69·9	29·3	40·6	54·2	42·1	28·9	12·1	47·5	41·2	·264	3·0	0·8	79	543	101·9	39·6	0·4	6	8	7	10	—	6·9	51
Somerleyton - -	—	72·0	29·0	43·0	57·8	41·5	35·6	16·3	47·8	—	—	—	—	—	—	—	—	1·0	6	9	9	6	7·3	6·4	54
Norwich - - -	29·510	71·5	31·0	40·5	57·1	43·6	30·7	13·5	48·7	45·5	·311	3·7	0·5	89	542	—	—	—	8	7	11	5	—	—	46
Wolverhampton -	29·532	70·5	24·1	46·4	55·4	40·3	32·7	15·1	46·5	40·8	·25[illegible]	3·0	0·7	81	535	—	—	—	6	9	9	6	—	8·0	60
Leicester - - -	29·555	68·3	26·8	41·5	55·4	42·9	32·9	12·5	48·3	41·4	·268	3·0	0·9	78	539	106·6	36·2	0·6	7	7	9	8	—	7·3	64
Nottingham - -	29·514	74·3	25·0	49·3	58·6	40·5	39·9	18·1	48·0	45·8	·294	3·3	0·6	87	540	101·0	39·2	0·3	7	9	6	6	3·2	6·9	67
Holkham - - -	29·520	71·3	24·7	46·6	56·8	39·8	37·7	17·0	46·9	43·5	·289	3·3	0·5	88	544	112·4	45·4	1·6	10	5	12	3	—	7·2	47
Llandudno - - -	29·538	67·8	30·0	37·8	54·1	43·9	25·0	10·2	48·3	42·4	·276	3·2	0·8	80	542	—	—	0·7	7	8	5	11	—	6·8	44
Kelstern Grange -	29·569	68·6	28·5	40·1	54·2	39·9	33·[illegible]	14·5	45·8	41·1	·262	3·0	0·[illegible]	81	539	108·8	37·8	0·9	7	8	9	7	8·6	7·1	60
Liverpool - - -	29·518	68·2	29·8	38·4	54·6	43·8	25·6	10·8	47·[illegible]	43·2	·285	3·2	0·7	84	540	—	—	1·1	6	7	6	11	—	6·8	58
Bolton - - - -	29·565	67·5	23·3	44·2	54·8	37·7	34·0	17·1	45·6	39·5	·245	2·8	0·7	79	537	69·7	33·3	1·4	8	9	7	7	5·9	7·0	57
Bermerside - -	29·376	75·0	28·3	46·7	55·8	39·8	37·1	16·0	46·2	40·7	·259	3·0	0·7	81	536	93·1	37·6	0·5	7	10	7	7	—	7·4	51
Hull - - - -	29·547	73·0	26·0	47·0	58·4	41·0	37·0	15·4	47·5	42·1	·277	3·2	0·7	83	545	79·8	38·0	—	—	—	—	—	2·5	—	63
Stonyhurst - -	29·549	70·0	27·5	42·5	57·0	40·7	33·1	16·3	47·0	40·7	·252	3·0	0·8	79	538	107·4	38·0	1·2	6	7	8	10	—	7·9	61
Leeds - - - -	29·562	72·0	28·0	44·0	58·0	41·5	31·7	16·5	48·1	40·2	·253	2·9	1·0	75	541	69·8	—	1·9	7	9	4	10	—	4·2	57
Bradford - - -	29·555	70·3	28·0	42·3	55·3	42·1	30·1	13·2	47·1	40·8	·252	3·0	0·8	79	541	75·1	—	1·1	10	7	6	7	—	7·1	70
Cockermouth - -	29·517	71·8	25·1	46·7	56·1	41·7	35·0	14·4	47·9	41·9	·273	3·1	0·8	80	541	101·7	36·1	0·3	6	10	5	9	2·[illegible]	7·0	44
Allenheads - - -	—	—	23·3	—	—	37·7	—	—	—	—	—	—	—	—	—	—	—	0·9	—	—	—	—	—	7·5	62
Silloth - - -	29·545	71·2	27·4	43·8	57·0	41·4	33·1	15·6	48·1	40·5	·257	2·9	0·9	75	543	91·6	37·2	1·2	3	10	5	12	8·5	5·8	48
Carlisle - - -	29·517	74·6	25·0	49·6	57·7	44·1	34·2	13·6	48·8	41·5	·266	3·0	1·0	76	540	90·9	34·7	0·8	6	11	4	9	3·6	7·8	39
Bywell - - - -	29·500	70·0	28·0	42·0	56·5	42·9	30·3	13·6	47·7	42·2	·273	3·2	0·[illegible]	82	542	73·1	37·6	1·2	5	12	6	8	—	5·8	62
North Shields - -	—	66·0	29·0	37·0	52·2	41·1	27·8	11·1	45·3	41·7	·268	3·0	0·5	87	546	—	40·7	1·4	9	8	5	8	—	6·6	57

The highest temperatures of the air were at Blackheath and Cambridge, both 75°·8; Ramsgate, 75°·2; Bermerside, 75°·0; Weybridge, 74°·8.

The lowest temperatures of the air were at Stockton, 21°·0; Bolton and Allenheads, both 23°·3; Weybridge, 24°·0; and Royston Wolverhampton, both 24°·1.

The greatest daily ranges of the temperatures of the air were at Weybridge, 19°·7; Salisbury, 19°·5; Royston, 18°·8; Stock 18°·4; Nottingham 18°·1 and Cambridge, 18°·0.

The least daily ranges of the temperatures of the air were at Llandudno, 10°·2; Guernsey and Liverpool, 10°·8; and Bour mouth, 10°·9.

The greatest number of rainy days were at Torquay and Bradford, both 70; Nottingham 67; Cambridge 66; Bath and Leicester, both and Hull, 63.

The least number of rainy days were at Carlisle, 39; Ramsgate, 41; Llandudno and Cockermouth, both 44; and Norwich, 46.

The heaviest falls of rain were at Torquay, 13·69 inches; Bolton, 13·51 inches; Bath, 13·07 inches; and Strathfield, 11·96 inches.

The least falls of rain were at Norwich, 5·15 inches; Lowestoft, 6·18 inches; Llandudno, 6·63 inches; and Cockermouth, 6·72 inche

QUARTERLY METEOROLOGICAL TABLE for different PARALLELS of LATITUDE.

NAMES of OBS

SOMERLEYTO Rectory, Rev. C. J. St
WOLVERHAM Wrottesley, E. Simpso
NORWICH (N Institution, John Quint
LEICESTER (T W. J. Harris
Seco

NOTTINGHAM M. O. Tarbot F.M.S.
HOLKHAM (N John David
LLANDUDNO James Nicol Thomas Da
KELSTERN (Lincolnshi D. Grant
LIVERPOOL John Hartn
BOLTON, Shar Rev. T. Macka
HALIFAX (Yorkshire) E. J. Crossl
HULL (Yorksh Mr. E. Pear
STONYHURST Rev. S. J. Perry F.R.A.S.
BRADFORD (Y J. McLands F.G.S.
LEEDS (Yorks Hall, H. Crowther

NAMES of ST. OBSERVERS

COCKERMOUTH (Cu H. Dodgson, Es F.R.A.S.
ALLENHEADS (N Mr. Thos. W. to W. B. Beaumont
SILLOTH (Cumb Rectory, Rev. F. Redford F.M.S.
CARLISLE (Cumb Isaac Cartmell
BYWELL (Northu Mr. John Daw the Earl of W. B. Beaumont
NORTH SHIELDS (N Robert Spence

METEOROLOGY OF ENGLAND,

DURING THE QUARTER ENDING SEPTEMBER 30, 1879.

REMARKS ON THE WEATHER DURING THE QUARTER ENDING SEPTEMBER 30TH, 1879.

By JAMES GLAISHER, ESQ., F.R.S., *&c.*

THE month of July was dull, very cold and sunless, with many days of temperature from 7° to 9° below their averages. Rain fell on every day during the first half of the month, and frequently afterwards, and snow fell at Bolton on both the 4th and 8th, and at Cockermouth on the 9th.

August was a month of very unsettled weather, with very little sunshine, about the middle of the month there were a few days whose mean temperature was equal to or slightly in excess of their averages, and during which period no rain fell, but rain was nearly continuous at all other parts of the month, it was a cold and very wet month, and thunderstorms were frequent.

September; during the first few days no rain fell, and it was fine and dry, but from the 6th, rain fell nearly daily, and the remainder of the month was cloudy and gloomy.

Till July 27th the average deficiency of mean temperature was 5° daily, and from July 28th to the end of the quarter, notwithstanding the few days of slightly excess of temperature, the deficiency of temperature was ¾° daily.

Thus the weather during the whole quarter has been cold, wet, and sunless, being a continuation of the bad weather which had been prevalent for the eight preceding months.

The month of September was the eleventh month in succession of low temperature, the mean temperature of the eleven months ending September 1879, are 46°·14. The instances of a mean temperature of about this value back to 1771 are:

In 1783–1784 the mean temperatures of eleven months ending September was 45°·71
1784–1785 „ „ „ 46°·06
1785–1786 „ „ „ 46°·14
1788–1789 „ „ „ 45°·73
1794–1795 „ „ „ 46°·18
1796–1797 „ „ „ 46°·11
1813–1814 „ „ „ 45°·23
1815–1816 „ „ „ 45°·91
1878–1879 „ „ „ 46°·14

Thus these are the only two instances in this century, viz,: in 1813–1814, and 1815–1816, when the temperatures of these eleven months were closely approximate to that of the present period.

The weather in the three months following September in the year 1784, 1785, and 1786, was cold; in 1789, 1797, and 1814 was cold, excepting December; in 1795 was warm in October and December, and cold in November; and in 1816 was cold in November and December. Therefore, as a rule, the same cold weather continued throughout the year.

The following table shows the mean temperature of the eleven months ending September in every year from 1772–1879.

TABLE showing the MEAN TEMPERATURE of the Eleven Months NOVEMBER to SEPTEMBER, from 1771—1772 to 1878—1879.

November to September.	Mean Temp. of the 11 months Nov. to Sept.	November to September.	Mean Temp. of the 11 months Nov. to Sept.	November to September.	Mean Temp. of the 11 months Nov. to Sept.	November to September.	Mean Temp. of the 11 months Nov. to Sept.	November to September.	Mean Temp. of the 11 months Nov. to Sept.	November to September.	Mean Temp. of the 11 months Nov. to Sept.
Years.	°	Years.	°	Years.	°	Years.	°	Years.	°	Years.	°
1771—1772	46·6	1789—1790	47·9	1807—1808	47·9	1825—1826	49·7	1843—1844	49·5	1861—1862	49·2
1772—1773	46·9	1790—1791	48·7	1808—1809	48·3	1826—1827	47·8	1844—1845	46·4	1862—1863	49·7
1773—1774	47·9	1791—1792	47·2	1809—1810	48·3	1827—1828	49·8	1845—1846	52·1	1863—1864	49·1
1774—1775	49·9	1792—1793	47·5	1810—1811	48·9	1828—1829	47·8	1846—1847	48·4	1864—1865	50·0
1775—1776	47·7	1793—1794	49·3	1811—1812	47·0	1829—1830	47·1	1847—1848	50·3	1865—1866	49·7
1776—1777	48·2	1794—1795	46·18	1812—1813	47·1	1830—1831	49·4	1848—1849	50·2	1866—1867	49·4
1777—1778	48·8	1795—1796	49·2	1813—1814	45·23	1831—1832	48·9	1849—1850	49·2	1867—1868	51·1
1778—1779	51·6	1796—1797	46·11	1814—1815	49·3	1832—1833	48·8	1850—1851	49·7	1868—1869	50·1
1779—1780	49·3	1797—1798	49·3	1815—1816	45·91	1833—1834	51·3	1851—1852	49·2	1869—1870	49·1
1780—1781	49·3	1798—1799	46·3	1816—1817	47·3	1834—1835	49·9	1852—1853	49·2	1870—1871	48·5
1781—1782	46·6	1799—1800	47·9	1817—1818	50·1	1835—1836	47·8	1853—1854	48·4	1871—1872	49·8
1782—1783	47·3	1800—1801	49·2	1818—1819	50·4	1836—1837	49·9	1854—1855	47·0	1872—1873	49·3
1783—1784	45·71	1801—1802	47·6	1819—1820	47·0	1837—1838	47·2	1855—1856	48·3	1873—1874	50·0
1784—1785	46·06	1802—1803	47·5	1820—1821	48·2	1838—1839	47·2	1856—1857	50·0	1874—1875	48·7
1785—1786	46·14	1803—1804	49·8	1821—1822	51·6	1839—1840	48·5	1857—1858	50·0	1875—1876	49·1
1786—1787	47·5	1804—1805	47·7	1822—1823	47·4	1840—1841	48·0	1858—1859	50·9	1876—1877	49·6
1787—1788	48·6	1805—1806	49·0	1823—1824	47·7	1841—1842	49·6	1859—1860	46·9	1877—1878	50·6
1788—1789	45·73	1806—1807	49·7	1824—1825	50·1	1842—1843	49·5	1860—1861	48·5	1878—1879	46·14
Mean -	47·8	Mean -	48·1	Mean -	48·2	Mean -	48·6	Mean -	49·1	Mean -	49·4

By comparing the last number 46°·14 with the numbers above it, the continued abnormal character of the weather for this long period is evident. The progressive increase of mean temperature is shown by the successive means of the 18 years in each column.

The fall of rain in the quarter has been remarkable, it fell on 53 days, and the amount collected was 11·75 ins., of which 5·2 ins. fell in August, the previous instances of such a large fall in this quarter are—in the year 1828, 13·8 ins., in the year 1829, 12·3 ins., in the year 1839 and 1867, 11·4 ins., and in 1875, 10·3 ins., in all other years the fall has been less than 10 ins.; this by itself would have been remarkable, but is much more so when added to the heavy falls of the preceding six months, viz., 17·3 ins., making the total fall this year to the end of September, the unprecedented amount of 29 ins.

The following table shows the fall of rain in the nine months ending September 30th, from 1815 to 1879:—

Year.	Amount in Inches.	Year.	Amount in Inches.	Year.	Amount in Inches.	Year.	Amount in Inches.	Year.	Amount in Inches.
1815	16·1	1828	26·5	1841	21·2	1854	13·3	1867	24·0
1816	21·2	1829	21·8	1842	16·3	1855	13·7	1868	16·1
1817	20·6	1830	21·8	1843	17·6	1856	18·3	1869	17·0
1818	19·5	1831	21·1	1844	16·2	1857	15·4	1870	10·9
1819	22·0	1832	14·0	1845	16·6	1858	14·2	1871	19·1
1820	21·0	1833	14·6	1846	17·6	1859	17·3	1872	18·7
1821	22·0	1834	16·8	1847	11·8	1860	25·1	1873	17·9
1822	17·1	1835	18·1	1848	22·9	1861	13·7	1874	12·8
1823	18·1	1836	18·7	1849	17·1	1862	19·7	1875	20·1
1824	25·4	1837	15·4	1850	14·5	1863	15·2	1876	13·7
1825	15·2	1838	16·8	1851	19·7	1864	12·4	1877	20·0
1826	16·9	1839	20·9	1852	22·2	1865	19·3	1878	23·8
1827	15·6	1840	13·3	1853	22·5	1866	24·8	1879	29·0

From this table it will seen that the nearest approach to the heavy fall of rain this year was in the year 1828, when 26·5 ins. were measured, but this is 2½ ins. short of the amount this year; the next in order of amount was in 1860, when 25·1 ins. was measured, in 1866, 24·8 ins., and in 1867, 24·0 in. It will be seen the smallest falls in the same time were 10·9 ins. in 1870, and 11·8 ins. in 1847.

The readings of the barometer in the neighbourhood of London were below their averages from the 1st to the 22nd of July, except on the 18th and 19th, which were 0·8 in. and 0·02 in. in excess of the average; the mean amount of defect of the 22 days was 0·28 in. From the 26th of May till the 22nd of July the readings were all below their average values, except on June 10th, 11th, 12th, 13th, 14th, and 30th, and July 18th and 19th, when the readings were respectively 0·08 in., 0·02 in., 0·02 in., 0·16 in., 0·21 in., 0·04 in., 0·08 in., and 0·02 in., above their averages. The mean amount of defect for these 58 days was 0·21 in. From the 23rd to the 30th of July the mean daily readings were all above their averages, the mean amount of excess for the 8 days was 0·11 in. From the 31st of July to 14th of August the readings were alternately above and below their averages, the mean of the 15 days being the same as the average. From the 15th to the 30th of August the barometer readings were all below their averages, the mean amount of defect for the 16 days was 0·25 in. Five days of readings above their averages followed, viz.:—August 31st to September 4th, the mean amount of excess was 0·18 in. From the 5th to the 24th of September, with the exception of the 19th and 20th, the readings were below their averages, the mean amount of defect for the 20 days was 0·19 in., and during the last 6 days of the quarter the readings were above their averages, the mean amount of excess was 0·28 in.

The mean reading of the barometer for July was 29·628 ins., being 0·177 in. below the average. It was lower than any value back to 1861 when the mean reading was 29·606 ins. The mean reading for August was 29·672 ins., being 0·114 in. below the average, and with the exception of that in 1878, it was lower than any value back to 1866. The mean reading for September was 29·802 ins. being 0.003 in. below the average.

The mean reading of the barometer for the quarter was 29·701 ins., being 0·098 in. below the average.

The atmospheric pressure in July was less than in June by 0·013 in., that of August was greater than in July by 0·044 in., and that in September was greater than in August by 0·130 in. (From the preceding 38 years' observations the *mean pressure* in July is less than in June by 0·007 in., that in August is less than in July by 0·019 in., and that in September is greater than in August by 0·019 in.) The mean increase of pressure from June to July south of latitude 52° was 0·023 in., and the mean decrease north of 52° was 0·012 in. The mean increase from August to September south of latitude 52° was 0·022 in., and north of 52° was 0·032 in. The mean increase from August to September south of latitude 52° was 0·126 in., and north of 52° was 0·144 in.

At Greenwich the *mean temperature* of July was higher than that of June by 1°·2; that of August was higher than that of July by 1°·8, and that of September was lower than that of August by 3°·6. (From the preceding 38 years' observations the *mean temperature* of July is higher than that of June by 3°·2, that of August is lower than that of July by 0°·7, and that of September is lower than that of August by 4°·4.) The *increase* of mean temperature from June to July from all places was 1°·5; the *increase* from July to August was 1°·9, and the *decrease* from August to September was 3°·4.

The mean temperature of the air for July was 58°·1, being 3°·5 and 4°·1, respectively, below the averages of the preceding 108 years, and 38 years. It was lower than any value back to 1860, when it was 57°·6.

The mean temperature of the air for August was 59°·9, being 1°·0 and 1°·6, respectively, below the averages of the preceding 108 years, and 38 years. It was lower than any value back to 1866, when it was 59°·4.

The mean temperature of the air for September was 56°·3, being 0°·2 and 0°·8, respectively below the averages of the preceding 108 years, and 38 years. It was lower than any value back to 1873, when it was 54°·7.

The mean temperature of the air for the quarter was 58°·1, being 1°·6 and 2°·2, respectively, below the averages of the preceding 108 years, and 38 years.

The mean high day temperatures of the air were 7°·2, 3°·7, and 2°·1, respectively, below their averages in July, August, and September.

The mean low night temperatures of the air were 1°·5, and 0°·2, respectively, below their averages in July and August, but 0°·2 above in September. Therefore the days and nights were cold throughout the quarter.

The mean daily ranges of temperature were 5°·7, 3°·4, and 2°·2, respectively, below their averages in July, August, and September.

The fall of rain at Greenwich in July was 3·7 ins., being 1·2 in. above the average; the fall in August was 5·2 ins., being 2·8 ins. above the average; and back to 1815 there is but *one* instance of so large a fall in the month of August, viz.:—In the preceding year 1878 when the fall was 5·4 ins. The fall of rain in September was 2·8 ins., being 0·4 in. above the average.

The total fall of rain in the quarter was 11·7 ins., being 4·4 ins. above the average of the preceding 64 years, and during this period of 64 years there have been but two instances (viz., 13·8 ins. in 1828, and 12·3 ins. in 1829) of so large a fall in the three months ending September 30th, as that in the present year.

At Bolton the fall of rain in these three months was 23·03 ins., and at Bath 19·92 ins.

1879. MONTHS.	Temperature of										Elastic Force of Vapour.		Weight of Vapour in a Cubic Foot of Air.	
	Air.			Evaporation.		Dew Point.		Air—Daily Range.		Water of the Thames.				
	Mean.	Diff. from average of 108 years.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.		Mean.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.
	°	°	°	°	°	°	°	°	°	°	in.	in.	grs.	gr.
July -	58·1	−3·5	−4·1	55·6	−2·1	53·4	−0·5	15·5	−3·7	60·5	0·409	−0·008	4·6	−0·1
August	59·9	−1·0	−1·6	57·4	0·0	55·2	+1·4	16·4	−3·4	62·9	0·436	+0·018	4·9	+0·8
Sept. -	56·8	−0·2	−0·8	53·8	−0·1	51·4	+0·4	16·3	−2·2	58·8	0·379	+0·001	4·3	−0·1
Means -	58·1	−1·6	−2·2	55·6	−0·7	53·3	+0·4	16·1	−3·8	60·7	0·408	+0·004	4·6	0·0

1879. MONTHS.	Degree of Humidity.		Reading of Barometer.		Weight of a Cubic Foot of Air.		Rain.		Daily Horizontal movement of the Air.	Reading of Thermometer on Grass.				
										Number of Nights it was			Lowest Reading at Night.	Highest Reading at Night.
	Mean.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.	Mean.	Diff. from average of 38 years.	Amount.	Diff. from average of 64 years.		At or below 30°.	Between 30° and 40°.	Above 40°.		
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
July -	84	+9	29·628	−0·177	529	+ 1	3·7	+1·2	314	0	0	31	40·0	58·5
August	85	+9	29·672	−0·114	528	0	5·2	+2·8	285	0	0	31	41·0	58·2
Sept. -	84	+4	29·802	−0·003	534	+ 1	2·8	+0·4	221	0	3	27	36·0	57·0
Means -	84	+7	29·701	−0·098	530	+ 1	Sum 11·7	Sum +4·4	Mean 273	Sum 0	Sum 3	Sum 89	Lowest 36·0	Highest 58·5

NOTE.—In reading this table it will be borne in mind that the plus sign (+) signifies *above* the average, and that the minus sign (−) signifies *below* the average.

The average duration of the different directions of the wind referred to eight points of the compass, and the duration of each direction in each month in the quarter were as follows:—

Direction of Wind.	JULY.			AUGUST.			SEPTEMBER.		
	Average.	1879.	Departure from Average.	Average.	1879.	Departure from Average.	Average.	1879.	Departure from Average.
	d.	d.	d.	d.	d.	d.	d.	d.	d.
N.W.	2½	5	+2½	2	1	−1	1½	4	+2½
N.	3½	1	−2½	3	0	−3	3½	2	−1½
N.E.	3¾	0	−3¾	3	1	−2	5½	4	−1½
E.	1¾	3	+1¼	1¼	1	− ¼	1¾	3	+1¼
S.E.	½	2	+1½	1¼	3	+1¾	1¾	3	+1¼
S.	2½	4	+1½	3	5	+2	2	2	0
S.W.	10½	6	−4½	10½	11	+ ½	7¼	8	+ ¾
W.	4	10	+6	3¾	9	+5¼	2½	3	+ ½
Calm (nearly.)	2½	0	−2½	3¼	0	−3¼	4½	1	−3½

The sign plus (+) denotes excesses over averages; the largest numbers affected with this sign in the month of July are opposite to the N.W., and W., in August to the S., and W., and in September to the N.W.

The sign minus (−) denotes defects below averages; the largest numbers affected with this sign in the month of July are opposite to the N., N.E., and S.W., and in the months of August and September to the N. and N.E.

MONTHLY METEOROLOGICAL TABLE FOR THE QUARTER ENDING DECEMBER 31ST, 1879.

The Observations have been reduced to Mean values by Glaisher's Barometrical and Diurnal Range Tables, and the Hygrometrical results have been deduced from the sixth edition of his Hygrometrical Tables.

NAMES of STATIONS and OBSERVERS.	Height of Station above Sea Level.	Year 1879.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.			Mean Degree of Humidity, Sat^n. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer.		Wind.					Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
								Mean						In a cubic foot of Air.							Relative Proportion of							
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.			Maximum in Rays of Sun.	Minimum on Grass.	Estimated Strength.	N.	E.	S.	W.			Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									
GUERNSEY, SAMUEL ELLIOTT HOSKINS, ESQ., M.D., F.R.S., F.M.S.	204	Oct.	29·875	0·888	64·0	39·0	25·0	57·2	48·3	8·9	52·9	49·1	·349	3·9	0·5	88	539	—	—	1·5	12	8	4	7	—	5·4	14	1·99
		Nov.	29·984	0·840	55·5	29·5	26·0	48·0	39·6	8·4	43·8	38·2	·230	2·7	0·6	81	552	—	—	1·3	12	8	4	6	—	5·9	9	1·65
		Dec.	30·083	1·515	52·0	25·0	27·0	44·0	33·0	11·0	38·8	31·1	·197	2·3	0·5	85	559	—	—	1·4	6	9	10	6	—	4·9	10	0·95
HELSTON (Cornwall), MATTHEW P. MOYLE, ESQ., M.R.C.S.	106	Oct.	30·229	0·807	70·0	36·0	34·0	60·6	48·0	12·6	53·2	48·2	·337	3·8	0·7	83	545	71·4	41·2	1·8	7	12	4	8	5·9	4·4	12	3·18
		Nov.	30·381	0·809	57·0	28·0	29·0	51·0	38·5	12·5	44·0	37·7	·228	2·6	0·7	78	559	62·9	35·8	1·3	14	10	3	8	4·6	5·3	7	3·43
		Dec.	30·456	1·264	59·0	27·0	34·0	48·0	34·4	13·6	41·0	35·8	·210	2·4	0·6	82	564	53·3	32·4	1·4	7	12	8	4	4·4	5·3	7	1·49
TRURO (Cornwall), C. BARHAM, ESQ., M.D., F.M.S.	43	Oct.	30·075	0·831	66·0	31·0	35·0	59·4	46·6	12·8	52·3	47·7	·331	3·7	0·7	84	544	—	—	2·2	4	13	4	10	—	6·7	13	2·44
		Nov.	30·227	0·819	56·0	25·0	31·0	50·0	35·6	14·4	42·4	37·1	·221	2·6	0·6	82	558	—	—	1·8	13	9	3	5	—	6·3	9	1·52
		Dec.	30·296	1·242	54·0	17·0	37·0	45·9	31·8	14·1	39·0	35·3	·206	2·4	0·4	87	563	—	—	1·7	7	8	8	8	—	6·9	13	1·55
PLYMOUTH (Devon), JOHN MERRIFIELD, ESQ., F.R.A.S., F.M.S., LL.D.	69	Oct.	30·116	0·944	64·2	34·0	30·2	57·8	46·6	11·2	51·7	48·0	·335	3·8	0·6	87	545	—	—	1·2	7	12	5	7	—	7·1	12	2·58
		Nov.	30·241	0·853	57·0	28·9	28·1	48·2	36·9	11·3	42·0	37·5	·225	2·6	0·5	85	558	—	—	1·8	11	9	3	7	—	6·9	6	0·55
		Dec.	30·301	1·352	53·0	20·8	32·2	42·7	31·0	11·7	37·4	33·6	·193	2·2	0·4	87	565	—	—	1·4	8	10	6	7	—	6·7	12	0·93
TORQUAY, Babbacombe (Devon), EDWIN E. GLYDE, ESQ., F.M.S.	305	Oct.	29·802	0·988	64·8	32·0	32·8	56·6	46·2	10·4	50·9	46·4	·316	3·6	0·6	85	540	100·7	41·0	1·6	6	12	3	10	3·8	7·5	11	0·80
		Nov.	29·904	0·872	59·8	25·4	34·4	47·6	37·0	10·6	42·0	38·6	·217	2·5	0·6	82	552	89·0	29·2	1·5	11	8	3	8	1·7	6·2	6	0·22
		Dec.	29·969	1·581	52·3	22·8	29·5	42·8	32·1	10·7	37·6	35·6	·193	2·2	0·5	85	559	75·6	23·8	1·4	7	8	7	9	2·0	6·3	13	1·44
VENTNOR, (Isle of Wight) (Royal National Hospital for Consumption), HARTLEY SAGAR, ESQ.	150	Oct.	30·054	1·084	63·0	35·0	28·0	56·7	47·9	8·8	52·0	49·4	·353	4·0	0·4	90	543	—	—	—	6	12	3	10	4·8	6·8	10	1·13
		Nov.	30·152	0·820	59·4	26·7	32·7	46·8	37·8	9·0	42·2	39·6	·243	2·8	0·3	90	556	—	—	—	12	8	2	8	2·6	6·0	8	0·66
		Dec.	30·250	1·312	50·3	21·3	29·0	42·2	33·2	9·0	36·0	36·1	·212	2·5	0·2	93	563	—	—	—	9	12	3	7	3·0	6·1	11	0·89
OSBORNE (Isle of Wight), J. R. MANN, ESQ.	172	Oct.	29·930	1·068	67·3	34·9	32·4	57·1	45·7	11·4	50·5	48·5	·342	3·9	0·3	93	543	87·5	42·6	0·2	7	9	5	10	—	6·6	9	0·82
		Nov.	30·029	0·896	55·5	25·8	29·7	45·4	35·1	10·3	39·8	37·6	·217	2·5	0·3	80	557	67·1	32·7	0·9	13	7	3	7	—	6·6	5	0·30
		Dec.	30·121	1·348	50·0	19·7	30·3	39·9	28·4	11·5	34·5	33·2	·190	2·2	0·2	95	565	48·5	25·2	0·2	7	10	8	6	—	6·7	2	0·94
EASTBOURNE (Sussex), MISS W. L. HALL.	12	Oct.	30·035	1·142	65·4	31·6	33·8	57·2	44·3	12·9	50·3	46·2	·313	3·6	0·6	86	545	87·0	35·3	0·4	8	12	2	9	1·0	—	11	1·37
		Nov.	30·109	0·798	55·1	21·3	33·8	45·5	33·7	11·8	39·8	35·5	·208	2·4	0·5	85	559	67·8	24·8	0·2	16	5	3	6	0·3	—	5	1·13
		Dec.	30·274	1·278	50·5	18·7	31·8	39·8	28·2	11·6	34·6	31·7	·179	2·1	0·3	89	568	46·9	19·1	0·8	12	8	5	6	0·9	—	9	0·86
BOURNEMOUTH, South Bourne, (Hants), T. A. COMPTON, ESQ., M.D., B.A., F.M.S.	95	Oct.	30·026	1·074	63·8	30·7	33·1	55·9	44·7	11·2	50·0	45·7	·306	3·5	0·6	85	545	—	—	1·2	11	9	2	9	—	5·9	11	1·16
		Nov.	30·130	0·818	59·8	23·0	36·8	45·5	34·4	11·1	39·6	35·0	·204	2·4	0·5	84	559	—	—	1·1	18	5	1	6	—	5·7	7	0·23
		Dec.	30·209	1·284	50·0	16·6	33·4	39·9	27·0	12·9	34·0	29·6	·164	1·9	0·4	83	567	—	—	1·3	13	9	3	6	—	6·5	11	1·04
BRIGHTON (Sussex), F. E. SAWYER, ESQ., F.M.S.	206	Oct.	29·912	1·132	64·8	32·0	32·8	56·2	44·9	11·3	50·0	45·9	·309	3·5	0·6	86	548	—	42·6	0·8	12	8	4	7	—	6·6	10	0·77
		Nov.	30·001	0·875	55·8	24·6	31·2	43·8	34·0	9·8	39·0	33·9	·195	2·3	0·5	83	558	—	30·9	0·7	18	5	2	5	—	7·4	3	1·06
		Dec.	30·108	1·423	48·2	20·2	28·0	38·7	28·7	10·0	34·2	30·4	·170	2·0	0·3	85	565	—	25·2	0·6	10	8	6	6	—	5·9	9	0·80
SALISBURY (Wilton House), Wilts, T. CHALLIS, ESQ.	186	Oct.	29·936	1·182	67·0	26·0	41·0	57·2	40·2	17·0	48·0	44·0	·287	3·3	0·5	87	546	81·8	37·2	1·1	8	11	4	8	—	6·9	14	0·85
		Nov.	30·020	0·846	62·0	18·0	44·0	46·9	30·5	16·4	38·5	35·4	·207	2·4	0·3	89	559	68·6	28·0	1·2	20	3	2	5	—	6·1	8	0·44
		Dec.	30·105	1·256	53·0	10·0	43·0	38·7	23·4	15·3	32·1	28·8	·158	1·9	0·2	89	568	53·0	22·7	1·3	16	8	5	2	—	7·0	9	1·16
BARNSTAPLE (Devon), WILLIAM KNILL, ESQ.	43	Oct.	30·077	1·010	70·0	32·0	38·0	59·3	47·2	12·1	52·6	48·4	·341	3·8	0·6	86	543	—	—	1·2	4	13	6	8	—	4·5	13	2·47
		Nov.	30·210	0·880	57·0	27·0	30·0	48·4	37·6	10·8	43·0	37·1	·221	2·6	0·6	80	557	—	—	1·1	15	5	1	9	—	3·8	5	0·80
		Dec.	30·257	1·230	56·0	21·0	35·0	42·0	30·1	11·9	36·8	33·2	·190	2·2	0·4	89	565	—	—	1·1	9	6	9	7	—	4·4	10	1·54
CATERHAM (Surrey), The Metropolitan Asylum, JAMES ADAM, ESQ., M.D.	608	Oct.	29·455	1·000	63·9	30·2	33·7	54·3	41·6	12·7	48·0	43·4	·281	3·2	0·6	85	537	—	32·1	2·3	7	11	6	6	—	5·8	12	1·78
		Nov.	29·517	0·800	51·0	22·2	28·8	41·3	31·7	9·6	36·8	33·5	·192	2·2	0·3	88	551	—	23·0	1·8	13	5	4	8	—	6·5	9	1·83

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1879.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.			Mean Degree of Humidity. Satn. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer.		Wind.					Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
								Mean						In a Cubic foot of Air.							Relative Proportion of							
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.			Maximum in Rays of Sun.	Minimum on Grass.	Estimated Strength.	N.	E.	S.	W.			Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
RAMSGATE (Kent), Rev. E. Douglas O'Gara, O.S.B., F.M.S.	108	Oct.	30·006	1·209	65·4	34·3	31·1	56·0	44·3	11·7	—	—	—	—	—	—	—	93·2	38·3	0·8	8	7	6	10	—	7·3	12	1·04
		Nov.	30·072	0·918	52·3	25·6	26·7	44·7	36·1	8·6	40·3	36·0	·211	2·5	0·5	85	557	68·3	32·6	0·9	8	5	4	13	—	7·8	15	0·84
		Dec.	30·200	1·380	50·5	20·9	29·6	38·2	28·3	9·2	33·5	31·0	·174	2·0	0·3	90	568	58·9	—	0·9	5	8	7	11	—	7·5	11	1·36
STRATHFIELD TURGISS (Hants), Rev. C. H. Griffith, M.A., F.M.S.	197	Oct.	29·926	1·139	66·0	30·1	35·9	56·5	42·1	14·4	48·6	45·9	·309	3·5	0·3	91	545	93·5	37·7	0·7	8	8	5	10	1·2	7·6	10	0·78
		Nov.	30·018	0·799	58·3	16·9	41·4	44·7	32·5	12·2	38·3	34·7	·201	2·3	0·4	88	559	67·8	28·5	0·7	13	8	3	6	0·9	6·7	11	0·80
		Dec.	30·101	1·279	52·4	10·7	41·7	37·7	25·0	12·7	32·2	29·6	·165	2·0	0·2	90	567	53·6	22·4	1·0	8	11	7	5	1·1	7·6	9	1·11
WEYBRIDGE HEATH (Surrey), William F. Harrison, Esq., F.M.S.	150	Oct.	29·994	1·156	68·5	28·0	40·5	55·9	42·1	13·8	48·5	43·7	·285	3·2	0·6	84	546	80·5	37·2	0·7	9	7	8	7	3·0	6·9	12	0·77
BATH (Somerset), St. Gregory's College, Downside, Rev. T. L. Almond, O.S.B., F.M.S.	506	Oct.	29·477	1·067	65·0	31·3	33·7	54·8	43·3	11·5	47·8	45·1	·300	3·4	0·4	91	538	85·3	39·1	1·5	8	8	5	10	—	7·5	13	1·91
		Nov.	29·576	0·829	56·8	26·0	30·8	44·6	33·7	10·9	38·7	36·4	·216	2·6	0·2	92	550	71·5	30·3	1·2	12	5	5	8	—	6·9	9	0·61
		Dec.	29·626	1·284	52·3	12·6	39·7	39·6	26·5	13·1	33·6	30·0	·167	2·0	0·3	87	557	58·1	22·7	1·4	7	6	7	11	—	7·2	9	3·01
MARLBOROUGH, (Wilts), Rev. Thomas A. Preston, M.A., F.M.S.	474	Oct.	29·620	1·124	66·9	28·2	38·7	55·8	41·9	13·9	48·3	44·3	·292	3·3	0·5	87	540	89·0	36·1	0·8	7	10	3	11	—	6·7	15	1·09
		Nov.	29·710	0·846	54·9	19·8	35·1	44·8	33·4	11·4	38·5	35·2	·205	2·4	0·4	88	553	—	27·2	0·5	9	8	1	12	—	7·6	11	0·59
		Dec.	29·775	1·324	53·3	13·4	39·9	38·6	26·4	12·2	32·5	29·8	·166	1·9	0·3	89	561	50·3	21·7	0·9	8	8	5	10	—	6·7	10	1·09
BLACKHEATH (London), James Glaisher, Esq., F.R.S.	160	Oct.	29·949	1·194	68·1	33·1	35·0	55·6	43·4	12·2	49·2	44·6	·296	3·4	0·6	85	545	85·8	39·6	0·9	5	10	4	12	—	7·1	11	0·84
		Nov.	30·029	0·845	54·2	23·0	31·2	43·3	33·6	9·7	38·5	33·8	·195	2·3	0·5	84	539	65·7	30·2	0·9	12	7	3	8	—	7·2	11	1·00
		Dec.	30·135	1·281	52·0	14·7	37·3	37·1	26·3	10·8	32·5	29·1	·161	1·9	0·3	87	568	49·2	23·3	0·7	6	8	7	10	—	7·8	8	0·64
STREATLEY (Berks), "The Vicarage," Rev. J. Slatter, M.A., F.R.S., F.M.S.	150	Oct.	29·974	1·134	66·7	31·0	35·7	56·7	44·2	12·5	50·4	44·8	·298	3·4	0·7	82	544	—	—	1·4	8	10	5	8	—	8·1	13	1·11
		Nov.	30·062	—	55·8	19·8	36·0	—	—	—	—	—	—	—	—	—	—	—	—	0·9	—	—	—	—	—	7·3	—	0·60
		Dec.	30·155	1·163	53·5	13·0	40·5	39·2	26·0	13·2	32·8	30·7	·172	1·9	0·2	93	568	—	—	0·8	10	5	7	9	—	7·2	5	0·62
CAMDEN SQUARE (London). G. J. Symons, Esq., F.R.S., F.M.S.	123	Oct.	29·995	1·187	67·4	33·4	34·0	57·1	43·9	13·2	49·6	45·4	·305	3·5	0·5	87	515	80·1	40·1	—	9	4	4	14	—	6·9	9	0·80
		Nov.	30·067	0·862	55·2	23·0	32·2	44·1	34·4	9·7	39·0	34·6	·201	2·3	0·5	85	559	63·7	30·1	—	15	2	2	11	—	6·2	8	0·73
		Dec.	30·175	1·289	53·4	16·1	37·3	37·7	26·9	10·8	32·0	28·0	·153	1·8	0·3	84	509	45·0	23·4	—	11	4	6	10	—	7·3	9	0·85
OXFORD (The Observatory), E. J. Stone, Esq., M.A., F.R.S.	210	Oct.	29·919	1·158	65·1	32·8	32·3	54·0	42·8	11·2	48·3	45·2	·301	3·4	0·4	90	545	83·7	38·8	1·0	7	8	5	11	0·9	8·0	10	0·73
		Nov.	29·996	0·855	53·4	22·1	31·3	44·1	33·6	10·5	38·7	35·6	·209	2·4	0·3	89	558	69·6	33·2	1·1	11	4	4	11	0·0	7·1	10	0·67
		Dec.	30·085	1·214	53·3	11·4	41·9	38·6	26·3	12·3	32·8	30·7	·172	1·9	0·2	82	566	51·1	24·2	1·0	7	6	8	10	0·5	7·8	11	0·72
ROYSTON (Hertfordshire), Hale Wortham, Esq., F.R.A.S., F.M.S.	269	Oct.	29·864	1·230	63·7	30·3	33·4	55·2	41·4	13·8	47·5	44·4	·292	3·3	0·5	90	545	—	—	—	9	7	4	11	—	7·0	8	0·59
		Nov.	29·938	0·862	52·7	21·4	31·3	43·8	32·0	11·8	38·0	34·4	·199	2·3	0·4	87	558	—	—	—	13	4	4	9	—	6·8	8	0·73
		Dec.	30·028	1·219	51·0	11·6	39·4	36·6	24·1	12·5	31·2	29·1	·160	1·9	0·2	91	567	—	—	—	3	4	12	12	—	7·2	10	0·53
BEDFORD, Cardington, Mr. J. MacLaren, Assistant to S. C. Whitbread, Esq., M.P.	105	Oct.	29·976	1·224	64·0	30·6	33·4	55·3	41·7	13·6	48·5	46·2	·314	3·5	0·3	92	546	67·8	37·7	1·1	7	9	3	12	—	7·0	9	0·80
		Nov.	30·077	0·790	54·6	20·4	34·2	44·0	32·4	11·6	38·1	35·2	·204	2·4	0·3	90	560	49·3	27·5	0·8	15	4	2	9	—	6·7	9	0·90
		Dec.	30·169	1·260	52·6	2·0	50·6	37·1	23·2	13·9	30·7	28·4	·157	1·9	0·2	91	571	39·1	19·4	1·0	7	4	9	11	—	7·5	9	0·56
CAMBRIDGE (Trinity College). J. W. L. Glaisher, Esq., M.A., F.R.S.	40	Oct.	30·031	1·236	65·0	28·0	37·0	56·7	42·4	14·3	49·0	45·9	·310	3·6	0·4	80	547	90·8	37·5	1·0	8	10	5	8	—	6·5	13	0·64
		Nov.	30·145	0·836	54·3	22·5	31·8	44·5	33·6	10·9	38·8	35·3	·207	2·4	0·4	84	561	70·3	28·3	1·0	16	2	6	6	—	7·1	15	0·93
		Dec.	30·242	1·276	53·0	−1·0	54·0	38·3	25·3	11·0	31·9	28·9	·161	1·9	0·2	88	571	55·0	22·1	1·0	5	4	15	7	—	5·8	15	0·74
RUGBY (Warwickshire), Stockton, "The Rectory," W. Tuckwell, Esq.	289	Oct.	29·810	1·121	65·5	26·0	39·5	56·4	42·3	14·1	49·0	44·2	·291	3·3	0·7	83	543	62·6	38·4	0·3	7	7	7	10	5·3	6·6	9	0·83
		Nov.	29·898	0·730	55·0	15·0	40·0	44·7	31·8	12·9	38·1	35·0	·204	2·4	0·4	80	557	47·6	—	0·4	13	5	3	9	2·8	7·1	10	0·74
		Dec.	29·955	1·180	59·0	−1·0	60·0	38·1	23·2	14·9	31·4	27·6	·150	1·9	0·2	85	566	40·1	—	0·3	8	5	8	10	2·8	6·9	6	0·71
LOWESTOFT (Suffolk), S. H. Miller, Esq., F.R.A.S., F.M.S.	85	Oct.	29·989	1·298	64·0	33·5	30·5	55·1	43·5	11·6	49·3	43·7	·286	3·3	0·8	81	546	80·6	40·7	1·1	8	8	2	13	—	6·4	14	1·41
		Nov.	30·053	0·950	53·9	25·6	28·3	44·6	35·0	9·6	39·9	35·5	·208	2·4	0·5	85	557	64·9	32·0	0·9	11	6	2	11	—	7·0	22	2·14
		Dec.	30·185	1·236	52·6	13·8	38·8	37·5	27·7	9·8	32·9	29·8	·166	1·9	0·3	87	568	54·0	25·7	0·8	6	5	6	14	—	6·4	14	0·64

Meteorological Table, Quarter ending December 31st, 1879.

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1879.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.			Mean Degree of Humidity, Satn. = 100.	Mean Weight of a cu. foot of Air.	Mean Reading of Thermometer.		Wind.					Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
								Mean						In a cubic foot of Air.							Relative Proportion of							
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.			Maximum in Rays of Sun.	Minimum on Grass.	Estimated Strength.	N.	E.	S.	W.			Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
SOMERLEYTON (Suffolk), The Rectory, Rev. C. J. Steward, F.M.S.	50	Oct.	30·048	1·318	68·2	33·2	35·0	57·2	44·7	13·5	49·6	47·6	·329	3·8	0·3	92	546	—	—	0·9	9	8	5	9	6·0	6·0	16	1·32
		Nov.	30·113	0·878	55·0	24·2	30·8	44·9	34·9	10·0	39·7	38·1	·230	2·7	0·1	94	558	—	—	1·0	11	7	6	6	6·1	7·3	21	2·84
		Dec.	30·249	1·302	51·0	10·0	41·0	37·2	25·7	11·5	31·9	28·6	·158	1·9	0·2	86	571	—	—	1·0	5	6	12	8	4·7	6·5	12	0·75
WOLVERHAMPTON (Staffordshire), Wrottesley, E. Simpson, Esq.	500	Oct.	29·555	1·172	61·7	30·2	31·5	53·9	41·8	12·1	46·9	44·0	·288	3·3	0·4	90	540	—	—	—	5	9	7	10	—	8·4	12	0·99
		Nov.	29·672	0·738	53·5	20·0	33·5	48·5	38·1	10·4	38·0	34·9	·203	2·3	0·4	89	553	—	—	—	12	3	5	10	—	7·3	10	0·87
		Dec.	29·722	1·118	53·6	12·5	41·1	36·9	25·4	11·5	31·6	28·3	·155	1·8	0·3	86	561	—	—	—	4	5	18	4	—	8·7	7	0·79
LEICESTER (Town Museum), W. J. Harrison, Esq., F.G.S.	238	Oct.	29·837	1·246	64·0	33·0	31·0	51·5	43·2	11·3	48·5	44·1	·290	3·3	0·5	85	544	85·2	35·7	0·7	8	8	7	8	—	7·9	16	1·21
		Nov.	29·935	0·892	55·2	23·5	31·7	44·5	34·4	10·1	39·3	35·9	·211	2·4	0·5	85	556	58·8	27·0	0·9	12	5	6	7	—	8·2	15	1·08
		Dec.	29·996	1·138	54·9	3·0	51·9	37·2	25·8	11·4	31·9	27·3	·148	1·7	0·4	82	566	45·4	20·0	0·7	5	7	10	9	—	9·1	11	0·62
NOTTINGHAM (Notts), M. O. Tarbotton, Esq., C.E., F.G.S., F.M.S.	183	Oct.	29·888	1·258	67·0	31·5	35·5	56·0	41·8	14·2	48·1	44·2	·289	3·3	0·5	87	545	76·7	41·1	0·3	8	9	6	8	0·8	7·6	17	1·11
		Nov.	29·997	0·740	55·1	18·0	37·1	45·1	33·4	11·7	38·9	35·1	·214	2·5	0·3	91	558	62·6	31·4	0·3	12	8	4	6	0·7	7·1	16	1·33
		Dec.	30·063	1·178	55·3	−1·3	56·6	37·6	24·3	13·3	31·2	28·4	·155	1·9	0·2	88	568	51·5	24·2	0·3	6	9	8	8	1·5	7·9	11	0·82
HOLKHAM (Norfolk), John Davidson, Esq., Assistant to the Earl of Leicester.	39	July	29·678	0·856	78·3	41·2	37·1	65·5	48·5	17·0	56·0	52·3	·391	4·4	0·6	87	532	111·9	43·9	1·7	5	1	17	8	—	7·0	16	3·67
		Aug.	29·758	0·814	75·1	40·9	34·2	67·8	47·3	20·5	57·4	51·8	·385	4·3	1·0	82	532	123·5	44·7	1·5	4	4	16	7	—	6·3	16	2·87
		Sept.	29·884	1·050	72·0	31·4	40·6	62·0	42·4	19·6	53·0	48·2	·337	3·8	0·7	84	539	111·2	39·9	1·6	9	4	12	5	—	5·6	12	2·80
		Oct.	30·028	1·316	62·4	24·6	37·8	55·3	38·1	17·2	47·5	41·6	·264	3·3	0·4	90	548	76·0	33·9	1·6	8	4	8	11	—	6·7	10	1·38
		Nov.	30·115	0·874	52·7	18·8	33·9	45·2	30·8	14·4	38·7	34·2	·198	2·3	0·5	85	560	75·0	25·5	1·4	12	5	6	7	—	7·5	17	1·95
		Dec.	30·215	1·298	53·5	5·4	48·1	38·3	22·2	16·1	31·8	29·2	·160	1·9	0·2	90	570	42·0	18·7	1·2	3	5	8	15	—	6·9	5	0·37
LLANDUDNO (Carnarvonshire), James Nicol, Esq., M.D., and Thomas Dalton, Esq., M.D.	100	Oct.	30·011	1·230	60·5	29·8	30·7	54·1	46·4	7·7	49·8	45·1	·300	3·5	0·6	85	545	—	—	1·0	4	8	6	13	—	7·0	11	1·63
		Nov.	30·150	0·860	54·2	32·0	22·2	47·3	40·1	7·2	43·9	37·8	·227	2·8	0·7	78	555	—	—	1·3	10	9	2	9	—	7·2	11	0·98
		Dec.	30·140	1·380	56·0	23·0	33·0	44·2	33·8	10·4	39·2	34·1	·197	2·3	0·5	83	560	—	—	0·9	3	4	8	16	—	6·0	11	1·48
KELSTERN GRANGE, near Louth (Lincolnshire), D. Grant Briggs, Esq., F.M.S.	326	Oct.	29·676	1·369	61·7	31·9	29·8	53·6	40·5	13·1	46·4	43·4	·282	3·2	0·4	90	547	88·7	38·1	1·0	10	5	5	11	6·6	6·1	13	1·23
		Nov.	29·762	0·983	55·5	24·5	31·0	43·3	32·8	10·5	37·7	35·1	·204	2·4	0·3	91	555	72·5	30·1	1·2	14	4	2	10	6·6	6·6	17	2·02
		Dec.	29·830	1·258	52·9	8·2	44·7	36·4	25·3	11·1	31·1	27·4	·149	1·7	0·4	85	564	59·5	—	1·1	6	5	9	11	5·2	6·3	11	1·06
LIVERPOOL, The Observatory, John Hartnup, Esq., F.R.A.S.	197	Oct.	29·887	1·284	60·5	36·6	23·9	53·8	45·0	8·8	48·4	45·5	·305	3·4	0·4	90	545	—	—	1·2	5	8	6	12	—	7·2	16	1·37
		Nov.	30·020	0·868	53·3	28·0	25·3	45·7	38·4	7·3	41·5	37·2	·223	2·6	0·5	86	555	—	—	1·1	11	5	4	10	—	6·0	8	1·41
		Dec.	30·026	1·382	56·0	21·5	34·5	40·6	30·4	10·2	35·6	32·5	·186	2·1	0·4	89	562	—	—	1·1	3	10	11	7	—	6·0	8	1·28
BOLTON, Sharples (Lancashire), Rev. T. Mackereth, F.R.A.S., F.M.S.	481	Oct.	29·559	1·290	63·0	28·5	34·5	53·1	39·0	14·1	46·2	42·1	·268	3·1	0·5	87	541	59·3	34·1	1·3	7	6	4	14	6·1	8·0	14	4·95
		Nov.	29·669	0·966	53·5	20·9	32·6	44·1	30·8	13·3	38·6	33·7	·19	2·2	0·5	83	552	52·7	26·0	1·8	13	6	3	8	5·8	6·4	13	1·60
		Dec.	29·695	1·242	53·2	13·5	39·7	39·1	23·4	15·7	32·6	28·3	·155	1·8	0·4	84	559	40·8	20·4	0·8	11	5	7	8	2·5	7·6	9	4·24
HALIFAX, Bermerside Observatory (Yorkshire), E. J. Crossley, Esq., F.R.A.S.	530	Oct.	29·521	1·316	67·0	30·0	37·0	53·3	42·0	11·3	46·4	44·3	·292	3·3	0·3	93	540	80·0	38·4	0·6	4	7	7	13	—	6·5	15	2·08
		Nov.	29·611	0·810	55·0	24·0	31·0	42·9	35·2	7·7	38·5	35·6	·193	2·2	0·5	83	552	62·3	31·1	0·7	10	6	4	10	—	6·9	9	1·64
		Dec.	29·652	1·360	51·0	10·0	41·0	37·6	28·0	9·6	32·9	29·6	·165	1·9	0·3	87	558	49·8	24·5	0·6	3	6	8	14	—	7·0	9	1·91
HULL (Yorkshire), The People's Park, Mr. E. Peake.	12	Oct.	30·080	1·420	63·0	30·0	33·0	55·4	40·9	14·5	48·0	42·3	·270	3·1	0·7	81	549	65·8	35·8	1·9	8	6	6	11	0·5	—	10	0·94
		Nov.	30·158	0·932	54·0	23·0	31·0	45·2	33·7	11·5	40·0	34·9	·203	2·4	0·5	72	560	54·6	28·9	1·7	14	5	3	8	1·2	—	19	1·97
		Dec.	30·237	1·254	54·0	7·0	47·0	37·5	25·9	11·6	32·6	27·7	·151	1·8	0·4	82	570	—	—	1·1	7	5	8	11	1·0	—	10	1·16
STONYHURST (Lancashire), Rev. S. J. Perry, F.R.S., F.M.S., F.R.A.S.	363	Oct.	29·707	1·306	62·9	28·0	34·9	54·1	41·4	12·7	47·2	42·8	·274	3·2	0·5	86	543	84·2	39·4	1·2	4	5	5	17	—	8·1	20	4·15
		Nov.	29·825	0·978	56·2	22·3	33·9	45·4	34·7	10·7	39·7	35·3	·207	2·4	0·5	85	554	75·6	30·8	1·4	10	5	5	10	—	6·7	15	1·32
		Dec.	29·842	1·284	54·2	12·0	42·2	39·3	26·8	12·5	33·2	29·1	·161	1·9	0·3	84	561	55·2	24·6	—	11	6	7	7	—	6·2	14	3·36
BRADFORD (Yorkshire), J. McLandsborough, Esq., C.E., F.G.S.	366	Oct.	29·682	1·381	63·2	32·8	30·4	53·8	42·0	11·8	47·2	43·0	·277	3·2	0·5	86	542	61·9	—	1·2	8	5	4	14	—	6·5	23	1·23
		Nov.	29·823	0·816	56·5	26·1	30·4	41·9	33·2	8·7	40·6	34·7	·201	2·3	0·6	80	551	53·6	—	1·2	13	8	1	8	—	5·9	15	1·43
		Dec.	29·829	1·369	51·0	13·2	40·8	38·9	28·7	10·2	34·6	30·6	·171	2·0	0·3	85	550	42·4	—	1·2	11	4	4	12	—	7·0	9	1·23
LEEDS (Yorkshire), The Philosophical Hall, H. Crowther, Esq.	137	Oct.	29·945	1·378	61·0	30·0	31·0	55·6	42·1	13·5	48·6	43·8	·287	3·2	0·6	84	545	67·9	—	1·0	6	6	5	14	—	3·2	10	0·71
		Nov.	30·076	0·881	58·0	26·0	32·0	47·2	34·8	12·4	41·2	34·0	·198	2·3	0·7	76	547	55·2	—	1·9	13	4	2	11	—	3·9	14	1·23
		Dec.	30·009	1·426	56·0	12·0	44·0	40·8	28·5	12·3	35·6	31·1	·175	2·0	0·4	81	564	41·8	—	1·8	5	6	5	15	—	4·1	10	1·24

Meteorological Table, Quarter ending December 31st, 1879.

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1879.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.					Mean Reading of Thermometer.		Wind.							Rain.	
								Mean						In a cubic foot of Air.							Relative Proportion of							
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.	Mean Degree of Humidity. Satn. = 100.	Mean Weight of a cubic foot of Air.	Maximum in Rays of Sun.	Minimum on Grass.	Estimated Strength.	N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
COCKERMOUTH (Cumberland), H. Dodgson, Esq., M.D., F.M.S., F.R.A.S.	146	Oct.	29·924	1·350	66·6	26·5	40·1	54·9	41·0	13·9	46·8	43·0	·277	3·1	0·5	87	547	81·9	33·3	0·3	4	9	7	11	0·9	6·4	15	2·62
		Nov.	30·075	1·020	57·1	17·9	39·2	45·3	35·0	10·3	39·6	35·9	·211	2·4	0·4	87	558	63·1	29·2	0·4	9	10	5	6	1·2	6·5	11	2·17
		Dec.	30·039	1·396	51·0	10·2	40·8	39·6	29·0	10·6	34·4	31·0	·173	2·1	0·3	86	561	43·7	23·8	0·6	7	9	5	10	2·0	6·2	12	3·50
SILLOTH (Cumberland), "The Rectory," Rev. F. Redford, M.A., F.R.A.S., F.M.S.	28	Oct.	30·060	1·566	65·0	28·7	36·3	54·0	39·7	14·3	45·9	43·1	·280	3·2	0·4	90	550	87·0	34·8	1·1	5	9	5	12	7·8	5·8	13	2·19
		Nov.	30·201	1·078	56·2	23·8	32·4	45·8	35·4	10·4	40·2	36·5	·216	2·5	0·4	87	560	79·2	29·2	1·1	9	10	4	7	8·1	5·3	7	1·54
		Dec.	30·174	1·439	50·5	8·0	42·5	39·2	27·6	11·6	33·6	30·2	·168	2·0	0·3	87	567	58·7	22·5	1·2	6	7	9	9	6·8	6·3	9	3·24
CARLISLE, Spital (Cumberland), Isaac Cartmell, Esq., F.M.S.	114	Oct.	29·951	1·338	66·5	26·6	40·2	54·7	38·7	16·0	46·0	41·9	·267	3·1	0·5	87	548	77·3	33·2	0·8	6	9	4	12	3·5	7·1	11	1·77
		Nov.	30·097	1·078	55·0	19·6	35·4	45·3	33·3	12·0	39·2	35·5	·208	2·4	0·4	87	559	62·3	27·3	0·9	10	8	2	10	3·4	6·0	8	1·10
		Dec.	30·073	1·380	54·6	1·5	53·1	39·1	25·3	13·8	32·4	29·0	·161	1·9	0·3	87	567	47·7	19·6	1·0	5	8	9	9	3·5	5·7	6	1·47
BYWELL (Northumberland), Mr. John Dawson, Assistant to W. B. Beaumont, Esq., M.P.	87	Oct.	29·938	1·332	65·0	31·0	34·0	56·0	42·0	14·0	47·5	42·2	·269	3·1	0·7	83	547	67·8	35·8	1·2	7	8	4	12	—	5·9	13	1·05
		Nov.	30·072	0·962	57·0	25·0	32·0	46·2	36·2	10·0	40·3	34·6	·201	2·4	0·5	81	558	59·0	29·8	1·4	8	11	2	9	—	6·0	19	2·41
		Dec.	—	—	—	1·0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	0·66
NORTH SHIELDS (Northumberland), Robert Spence, Esq.	124	Oct.	30·000	1·503	59·2	31·4	27·8	52·7	41·1	11·6	45·8	42·4	·271	3·1	0·5	88	550	—	40·6	1·4	12	4	3	12	—	4·5	17	0·69
		Nov.	30·147	1·087	55·5	26·5	29·0	44·8	35·6	9·2	40·0	35·9	·211	2·4	0·5	86	559	—	35·2	1·6	15	5	1	9	—	5·9	21	3·82
		Dec.	30·147	1·571	54·3	8·5	45·8	38·7	28·9	9·8	34·1	31·6	·179	2·1	0·3	90	556	—	28·3	1·4	12	1	3	15	—	5·0	11	0·68
WARINGSTOWN, Co. Down (Ireland), Thomas Waring, Esq.	191	Oct.	29·865	1·122	64·0	32·0	32·0	54·3	41·4	12·9	47·1	44·8	·297	3·4	0·3	92	545	79·7	39·1	2·4	8	7	5	11	—	5·1	14	1·32
		Nov.	30·024	0·830	57·0	20·0	37·0	47·3	36·3	11·0	41·7	37·4	·225	2·6	0·5	88	555	69·5	32·4	2·4	12	6	8	9	—	4·4	15	1·29
		Dec.	29·906	1·318	55·0	12·0	43·0	41·2	28·5	12·7	35·0	31·9	·180	2·1	0·3	88	561	57·4	25·6	2·2	4	2	9	16	—	4·4	10	1·64

Second Rain-gauges are placed—

				October.		November.		December.		Total in Quarter.
At Beachy Head,	at the height of	515 feet	*above the sea*, the amount collected was	0·74 inches.	-	0·53 inches.	-	0·57 inches.	-	1·84 inches.
,, ,,	,,	495 feet	,, ,,	1·02 ,,	-	0·95 ,,	-	0·55 ,,	-	2·52 ,,
,, Strathfield Turgiss,	,,	38 feet	*ground* ,,	0·54 ,,	-	0·56 ,,	-	0·77 ,,	-	1·87 ,,
,, Oxford,	,,	22 feet	,, ,,	0·74 ,,	-	0·66 ,,	-	0·81 ,,	-	2·21 ,,
,, Cardington,	,,	36 feet	,, ,,	0·60 ,,	-	0·60 ,,	-	0·40 ,,	-	1·60 ,,
,, Nottingham,	,,	39 feet	,, ,,	1·07 ,,	-	1·34 ,,	-	0·78 ,,	-	3·19 ,,

NOTE.—The *Barometer Reading*, BARNSTAPLE, 7th November, at 9h. a.m., 29·68 inches, has been altered to 30·68 inches.
,, BARNSTAPLE, 11th December, at 3h. p.m., 29·58 ,, ,, 30·58 ,,

The Maximum Thermometer Reading, DOWNSIDE, Bath, 15th December, 63°·6, has been altered to 43°·6.

The mean daily ranges of temperature were 2°·2 and 1°·4, respectively, below their averages in October and November, but 1°·2 above in December.

The fall of rain at Greenwich in October was 0·8 in., being 2·0 ins. below the average; and back to 1815 there are but two instances of so small a fall, viz.:—In 1830 it was 0·8 in., and in 1834 it was 0·4 in. The fall in November was 0·9 in., being 1·5 ins. below the average; and back to 1815 there are but four instances of so small a fall, viz.:—In 1851 it was 0·6 in., in 1858 it was 0·5 in., in 1867 it was 0·4 in., and in 1871 it was 0·6 in. The fall of rain in December was 0·6 in., being 1·4 ins. below the average, and since 1815 there are but nine instances of so small a fall.

Thunderstorms occurred on one day in October, and on 3 days in December.
Thunder was heard but lightning was not seen on one day in October and December.
Lightning was seen but thunder was not heard on 2 days in November.
Solar halos were seen on 3 days in October, one day in November, and on 3 days in December.
Lunar halos were seen on 2 days in October, 2 days in November, and on 6 days in December.
Snow fell on 2 days in October, 16 days in November, and 11 days in December.
Hail fell on 6 days in October, 13 days in November, and on 6 days in December.
Fog prevailed on 21 days in October, 18 days in November, and on 26 days in December.

Thermometer.	Lowest Reading of the Thermometer.	Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	WIND. Mean Estimated Strength.	WIND. Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	RAIN. Number of Days on which it fell.	Amount collected.
°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
·0	25·0	39·0	49·7	40·3	26·0	9·4	45·2	40·5	·259	3·0	0·5	85	550	—	—	1·4	10	8	6	6	—	5·4	33	[illegible]
·0	25·0	45·0	53·2	40·8	32·5	12·9	46·1	40·6	·258	2·9	0·7	81	556	62·5	37·5	1·5	9	11	5	5	5·0	5·6	26	[illegible]
·0	17·0	49·0	51·8	38·0	34·5	13·8	44·6	40·0	·253	2·9	0·6	84	555	—	—	1·9	8	10	5	8	—	6·6	35	[illegible]
·2	20·8	43·4	49·6	38·2	30·2	11·4	43·7	39·7	·251	2·9	0·5	86	556	—	—	1·5	9	10	5	7	—	6·9	30	[illegible]
·8	22·8	42·0	49·0	38·4	32·2	10·6	43·5	38·9	·242	2·8	0·6	84	550	88·4	31·3	1·5	8	9	4	9	2·5	6·7	30	[illegible]
·0	21·3	41·7	48·6	39·6	29·2	9·0	44·1	41·7	·239	3·1	0·3	91	554	—	—	—	9	11	3	8	3·5	6·3	29	[illegible]
·3	19·7	47·6	47·5	34·4	30·8	11·1	41·6	39·4	·250	2·9	0·3	92	555	67·7	33·5	0·4	9	9	3	8	—	6·6	16	[illegible]
·8	16·6	47·2	47·1	35·4	34·4	11·7	41·2	36·8	·225	2·6	0·5	84	557	—	—	1·2	14	8	2	7	—	6·0	29	[illegible]
·8	20·2	44·6	46·2	35·5	30·7	10·4	41·1	36·7	·225	2·6	0·5	85	553	—	29·9	0·7	13	7	4	6	—	6·6	22	[illegible]
·0	10·0	57·0	47·6	31·1	42·7	16·2	39·5	33·1	·217	2·5	0·5	88	558	67·8	29·3	1·2	15	7	4	5	—	6·7	31	[illegible]
·0	21·0	49·0	49·9	38·3	34·5	11·6	44·1	39·6	·251	2·9	0·5	85	557	—	—	1·1	9	8	5	8	—	4·2	28	[illegible]
·4	20·9	44·7	46·3	35·2	29·1	10·1	—	—	—	—	—	—	—	73·3	—	0·9	7	7	6	11	—	7·5	38	[illegible]
·0	10·7	55·2	46·3	33·2	49·7	13·1	39·7	36·7	·225	2·6	0·5	90	557	71·6	29·7	0·8	10	9	5	7	1·1	7·5	39	[illegible]
·0	12·6	52·4	46·3	34·5	34·7	11·8	40·0	37·2	·228	2·7	0·5	90	548	71·6	30·7	1·4	9	6	6	10	—	7·5	31	[illegible]
·9	13·4	53·5	43·4	33·9	37·9	12·5	39·8	36·4	·221	2·5	0·4	88	551	—	35·3	0·7			3	11	—	7·0	36	[illegible]
·1	14·7	55·4	45·3	34·4	34·5	10·9	40·1	35·8	·217	2·5	0·5	85	557	73·6	31·6	0·8	8		5	10	—	7·4	30	[illegible]
·7	13·6	53·7	—	—	37·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7·5	—	[illegible]
·4	16·1	51·3	46·3	35·3	34·5	11·3	40·2	36·0	·220	2·5	0·4	85	558	62·9	31·2	—	12	3	4	12	—	6·8	30	[illegible]
·1	11·4	53·7	45·6	31·2	35·2	11·4	39·9	37·2	·227	2·6	0·3	90	556	68·1	32·1	1·0	8	6	6	11	0·5	7·6	31	[illegible]
·7	11·6	52·1	45·2	32·5	34·7	12·7	38·9	36·0	·217	2·5	0·4	89	557	—	—	—	8	5	7	11	—	7·4	26	[illegible]
·0	2·0	62·0	45·5	32·4	39·4	13·1	39·1	36·6	·225	2·6	0·3	91	559	52·1	28·2	1·0	10	6	5	10	—	7·1	27	[illegible]
·0	−1·0	66·0	45·8	33·8	40·9	12·0	40·0	36·7	·226	2·6	0·3	88	560	72·0	29·3	1·0	10	5	9	7	—	6·5	41	[illegible]
·5	−1·0	65·5	46·4	32·4	46·5	14·0	39·5	35·6	·215	2·5	0·4	86	555	50·1	—	0·3	9	6	6	10	3·6	6·9	25	[illegible]
·0	13·8	50·2	45·7	35·4	32·5	10·3	40·7	36·3	·220	2·5	0·5	84	557	66·5	32·8	0·9	8	6	3	14	—	6·6	30	[illegible]
·2	10·0	58·2	46·4	34·8	45·6	11·7	40·1	38·1	·239	2·8	0·2	91	558	—	—	1·0	8	7	8	5	5·6	6·6	49	[illegible]
·7	12·5	49·2	44·8	33·4	35·4	11·3	38·8	35·7	·215	2·5	0·4	85	551	—	—	—	7	6	10	8	—	5·1	29	[illegible]
·0	3·6	51·6	45·4	34·5	38·2	10·9	39·0	35·8	·216	2·5	0·5	84	552	63·1	27·4	0·8	8	7	8	8	—	8·4	42	[illegible]
·0	−1·5	58·5	46·2	33·2	43·2	13·6	39·4	36·2	·219	2·6	0·3	89	557	63·6	32·2	0·3	9	9	6	7	1·0	7·3	41	[illegible]
·5	24·0	37·5	44·5	40·1	25·3	8·4	44·3	39·0	·241	2·9	0·6	82	553	—	—	1·1	6	7	5	13	—	6·7	43	[illegible]
·7	8·2	53·5	44·4	32·9	35·2	11·5	38·4	35·3	·212	2·4	0·4	89	554	73·6	—	1·1	10	5	5	11	6·1	6·3	41	[illegible]
·5	21·5	39·0	46·7	37·9	27·9	8·8	41·8	38·4	·205	2·7	0·4	88	554	—	—	1·1	6	8	7	10	—	6·4	32	[illegible]
·0	13·5	49·5	45·4	31·1	35·6	14·3	39·1	34·7	·205	2·4	0·5	85	552	50·9	26·8	1·3	10	6	5	10	4·8	7·3	36	[illegible]
·0	10·0	57·0	44·6	35·1	40·3	9·5	39·3	35·8	·217	2·5	0·4	88	550	64·0	31·3	0·6	6	6	6	12	—	6·8	33	[illegible]
·0	7·0	56·0	46·0	33·5	37·0	12·5	40·2	35·0	·208	2·4	0·5	78	560	—	—	1·6	10	5	6	10	0·9	—	39	[illegible]
·9	12·0	50·9	46·3	34·3	37·0	12·0	40·0	35·7	·214	2·5	0·4	85	553	72·7	31·6	—	8	5	6	11	-	7·0	49	[illegible]
·2	13·2	50·0	45·9	35·6	33·9	10·3	40·8	36·1	·216	2·5	0·5	84	551	52·0	—	1·2	11	6	3	11	—	6·5	47	[illegible]
·0	12·0	52·0	47·0	35·1	35·7	12·7	41·8	36·3	·219	2·5	0·6	81	555	54·8	—	1·9	8	5	4	13	—	3·7	34	[illegible]
·6	10·2	56·4	45·6	35·0	40·0	11·6	40·3	36·6	·220	2·5	0·4	87	556	62·9	29·4	0·4	7	9	6	9	1·4	6·4	38	[illegible]
·0	8·0	57·0	46·3	34·2	37·1	12·1	39·9	36·6	·231	2·6	0·4	88	559	75·0	28·8	1·1	7	9	6	9	7·6	5·8	29	[illegible]
·8	1·5	47·3	46·4	32·4	42·9	13·9	39·2	35·5	·212	2·5	0·4	87	558	62·4	26·7	0·9	7	8	5	10	3·5	6·5	25	[illegible]
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	37	[illegible]
·2	8·5	50·7	45·4	35·2	34·2	10·2	40·0	35·6	·220	2·5	0·4	88	553	—	34·7	1·5	13	3	2	12	—	5·1	49	[illegible]

f the air were at Helston and Barnstaple, both 70°·0; Somerleyton, 68°·2; and Blackheath, 68°·1.
the air were at Nottingham, −1°·3; Cambridge and Rugby, both −1°·0; Carlisle, 1°·5; Cardington, 2°·0;
Silloth, 8°·0; Kelston Grange, 8°·2; and North Shields, 8°·5.
f the temperatures of the air were at Salisbury, 16°·2; Bolton, 14°·3; Rugby, 14°·0; and Carlisle 13°·9.
he temperatures of the air were at Llandudno, 8°·4; Liverpool, 8°·8; Ventnor, 9°·0; and Guernsey, 9°·4.
y days were at Lowestoft, 50; Somerleyton, Stonyhurst, and North Shields, all 49; and Bradford 47.
days were at Osborne, 16; Brighton, 22; Rugby and Carlisle, both 25; and Helston, Camden Square, and

a were at Bolton, 10·79 inches; Stonyhurst, 9·03 inches; Cockermouth, 8·29 inches; and Helston,

it at Royston 1·90 inches; Osborne, 2·06 inches; Oxford, 2·12 inches; and Cardington, 2·26 inches.

RLY METEOROLOGICAL TABLE for different PARALLELS of LATITUDE.

of the Sea.	Mean of all Highest Readings of the Thermometer.	Mean of all Lowest Readings of the Thermometer.	Mean Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	WIND. Mean Estimated Strength.	WIND. Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	RAIN. Mean Number of Days it fell.
h.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°								
048	64·0	25·0	39·0	49·7	40·3	26·0	9·4	45·2	40·3	·259	3·0	0·5	85	550	—	—	1·4	10	8	6	6	—	5·4	33
022	65·5	20·4	45·1	49·1	37·8	31·6	11·3	43·2	39·2	·247	2·8	0·5	86	555	72·9	33·8	1·2	10	10	4	7	3·7	6·8	27
002	66·8	14·4	52·4	46·7	34·6	36·0	12·1	40·4	36·9	·226	2·6	0·4	88	555	69·9	30·3	1·0	10	7	5	9	0·8	6·9	31
976	64·8	5·5	59·3	45·7	33·6	38·5	12·1	39·6	36·3	·221	2·6	0·4	87	557	61·2	30·0	0·8	9	6	7	9	3·4	7·2	37
977	62·9	13·4	49·5	46·2	35·1	33·8	11·1	40·6	36·3	·215	2·5	0·5	84	554	61·4	29·9	1·2	8	6	5	11	3·9	6·3	38
956	66·1	6·6	59·5	46·4	33·9	40·0	12·5	39·8	36·2	·218	2·5	0·4	87	558	66·8	28·3	0·8	7	9	6	9	4·2	6·2	33
456	69·5	24·9	44·6	51·9	41·8	33·1	10·1	46·5	42·8	·278	3·2	0·5	87	541	66·6	37·0	1·1	5	8	10	7	3·5	7·1	55
604	66·7	27·2	39·5	51·6	49·5	30·5	12·1	45·4	41·0	·259	3·0	0·5	85	545	71·7	33·9	1·3	5	3	9	13	4·1	6·0	58
513	70·0	12·9	57·1	46·7	35·5	33·9	11·2	40·9	36·7	·227	2·6	0·5	86	547	66·9	30·6	1·1	9	5	6	10	3·8	6·4	49
967	65·2	12·1	53·1	46·8	35·0	36·0	11·8	40·7	37·0	·226	2·6	0·4	86	556	66·4	30·5	1·0	9	8	5	9	3·2	6·6	33

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